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ABSTRACT

This book contains 37 papers on computer use in higher education originally presented at a May, 1992, conference of college and university computer users. Most of the papers describe programs or systems implemented at particular institutions and cover the following: systems for career planning, automating purchasing and financial commitments, student information systems, database operations, a computerized multi-campus transfer information system, degree audit systems, distributed financial information systems, electronic exchange of student transcripts, distributed computing, data management and admissions recruitment, user-oriented general ledger systems, virtual reality, reengineering for administrative processes, class scheduling and enrollment management, microcomputer applications, applications for touch-tone systems, Guaranteed Student Loan Systems, imaging, future trends in information technology, electronic report distribution systems, computer-assisted advising systems, automating the federal verification process, electronic transcript processing, leveraging investments in older technology, the CHRONOS system, decentralized budget preparation, administrative data requirements for instructional effectiveness, information access to corporate data, the implementation and management of a large complex fiber optic network, and data quality and quantity. (JB)

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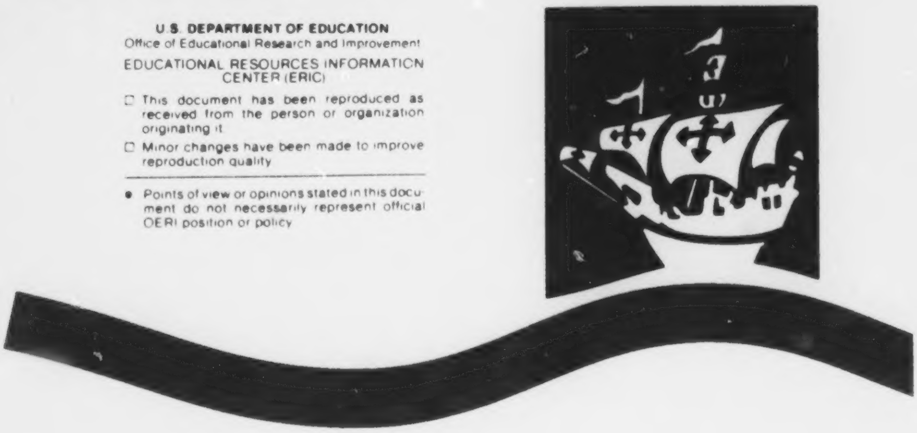

"Discover New Worlds With Technology"

Miami-Dade Community College

HE026 041

May 3-6, 1992

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37th Annual College and University
Computer Users Conference

CUMREC '92

"Discover New Worlds With Technology"

Miami-Dade Community College

May 3-6, 1992

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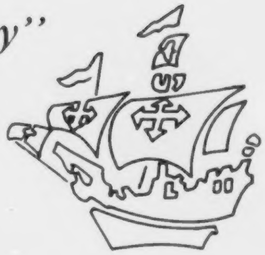
"Discover New Worlds With Technology"



M2-1

Career Planning and Placement — An Administrative System for Student Use

Beth Hernandez
University of Miami

Career Planning and Placement - An Administrative System for Student Use

Beth Hernandez
Systems Analyst
University of Miami

At the University of Miami, we are proud to announce a new group of users for our computer systems, the students. The new online Career Planning and Placement system will be the first system at the university to allow "students" to populate and retrieve data from our IDMS database. This will reduce the administrative workload, while giving the students the freedom to schedule interviews right from their home or dorm room.

The system automates a full range of functions relating to student and alumni employment:

- Student have online update capabilities on the Career Planning and Placement system for job application and interview scheduling.
- Online job listings are provided for students to review summer, part-time and full-time jobs, including college work study.
- Employers are provided with computerized interview schedules, personal data sheets and resumes.
- Employers visiting the campus can pre-select a portion of the students they will interview.
- Workshops to teach resume writing, interviewing skills, etc. are created and maintained on the system. An online calendar is available to the students to view and sign up for these workshops.
- The system assists students in finding mentors locally and in major cities in the United States.
- Files are created for ad hoc reporting.
- A comprehensive set of statistical and detail reports for management use are provided on a regular basis.
- The system has the appropriate audit controls and security.

The University of Miami's new Career Planning and Placement system consists of two independent applications, a system for the students and a system for the administration. The student Career Planning and Placement system can be accessed through EASY, the university student system. EASY is "easy" to use. Students can gain access to their own grades, schedules, etc. by typing in an id number and a pin number. EASY can be accessed by the students through modems, terminals in campus labs and dorm rooms, and in the Career Planning and Placement office. The administrative system can be considered a complete reservations system. It sets up, cancels and customizes interview schedules. This includes activities, representative and company information associated with a visit.

The first phase of the Career Planning and Placement system is in operation. It includes on-campus recruiting, activities, University workshops, Special events, company and representative data maintenance and various comment screens. Thirty-nine administrative screens and twenty-one student screens are currently being used.

Administrative System

It is important that the Career Planning and Placement office make a recruiter's visit productive. The new computerized system accomplishes this by allowing the recruiters to customize their interviewing schedules. Recruiters may tailor the beginning and ending times of their interviews as well as the length of the interviewing time slots. Lunch lengths and lunch begin and end times are also flexible.

8

```
              CAREER PLANNING AND PLACEMENT
                  MODIFY VISIT DATES

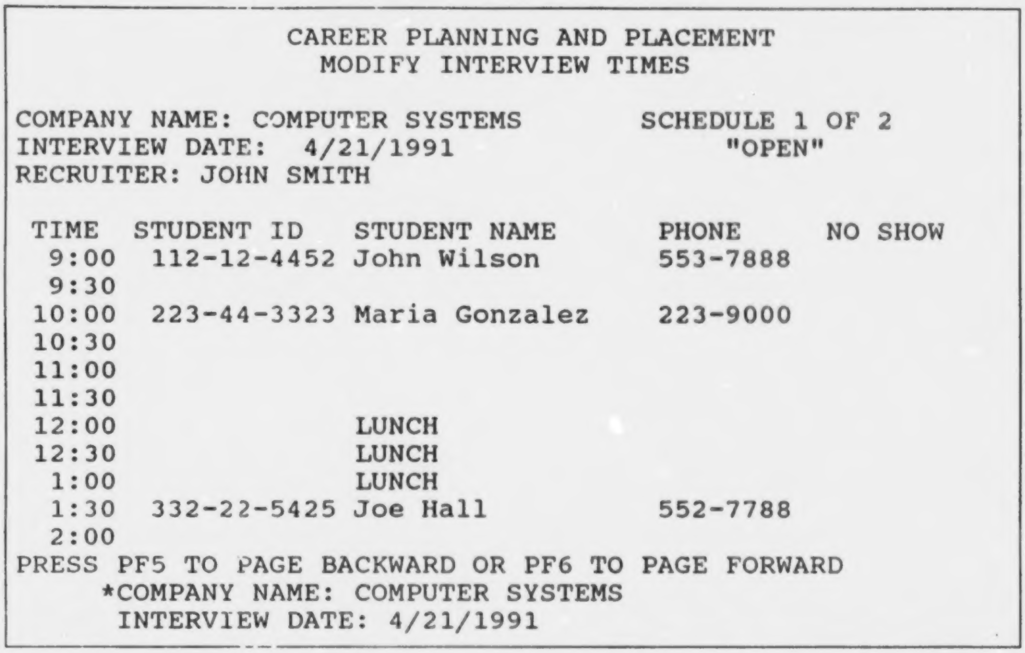

COMPANY NAME: COMPUTER SYSTEMS
VISIT DATE:  4/22/1991        VISIT REF NUM: V-111111

LOCATION: ..............

DAY BEGIN:   9:00      DAY END:  5:00   LENGTH: 30
LUNCH BEGIN 12:00    LUNCH END:  1:30 NUMBER OF SCHEDULES:
---------------------------------------------------------
SCHEDULE
 NUM      REPRESENTATIVE                 OPEN    CLOSED
  1       JOHN SMITH                              ALL
  2          TBA-2                        AM       PM
  3          TBA-3                        ALL
  4          TBA-4

  *COMPANY NAME: COMPUTER SYSTEMS
       VISIT DATE:  4/22/1991
```

Holds can be placed in the interview slots at a representative's request. After an interview, an administrator must go back into the modify interview times screen and mark any student that missed the interview as a "no show." Once a student has one "no show" a hold is placed on their file. The student will not be allowed to sign up for further interviews until a letter of apology has been sent to the company and an administrator removes the hold. If a student has 2 "no shows", the system will remove them from their current interviewing schedule, as per office policy.



```
              CAREER PLANNING AND PLACEMENT
                 MODIFY INTERVIEW TIMES

COMPANY NAME: COMPUTER SYSTEMS       SCHEDULE 1 OF 2
INTERVIEW DATE:  4/21/1991                "OPEN"
RECRUITER: JOHN SMITH

 TIME  STUDENT ID   STUDENT NAME       PHONE     NO SHOW
  9:00  112-12-4452 John Wilson        553-7888
  9:30
 10:00  223-44-3323 Maria Gonzalez     223-9000
 10:30
 11:00
 11:30
 12:00              LUNCH
 12:30              LUNCH
  1:00              LUNCH
  1:30  332-22-5425 Joe Hall           552-7788
  2:00
PRESS PF5 TO PAGE BACKWARD OR PF6 TO PAGE FORWARD
     *COMPANY NAME: COMPUTER SYSTEMS
      INTERVIEW DATE: 4/21/1991
```

The Career Planning and Placement system allows the recruiter to target student and alumni groups they wish to interview. By specifying visit requirements such as minimum GPA, major and degree requirements, etc., the system will only allow students who meet the desired criteria to sign up for the interview schedule. This will avoid students from signing up for interviews for which they are not qualified. Other requirements such as language or relocation restrictions will also be displayed to the students.

Often recruiters wish to pre-select the students they wish to interview. This is called a closed schedule. Through EASY, (the student system) students will be placed on a closed schedule list. Their personal data sheets and a copy of their resume is then sent to the recruiters, so that the recruiters can select who they would like to interview and notify the Career Planning and Placement office. The office then accesses the administrative screen "Closed Schedule Selection" and marks the selected students. When the student signs on to EASY, a message on the Welcome screen notifies the student he/she has been selected to interview for the schedule. The student now selects an interviewing time slot on the closed schedule. On the sign-up column below, the Career Planning and Placement office can determine if any pre-selected students have not selected a time on the closed schedule. They can then, personally notify these students that they have been selected to interview on the closed schedule. In the past, the office had to call each student and schedule them for an interview over the telephone. EASY will eliminate this administrator's task.

```
              CAREER PLANNING AND PLACEMENT
                CLOSED SCHEDULE SELECTION

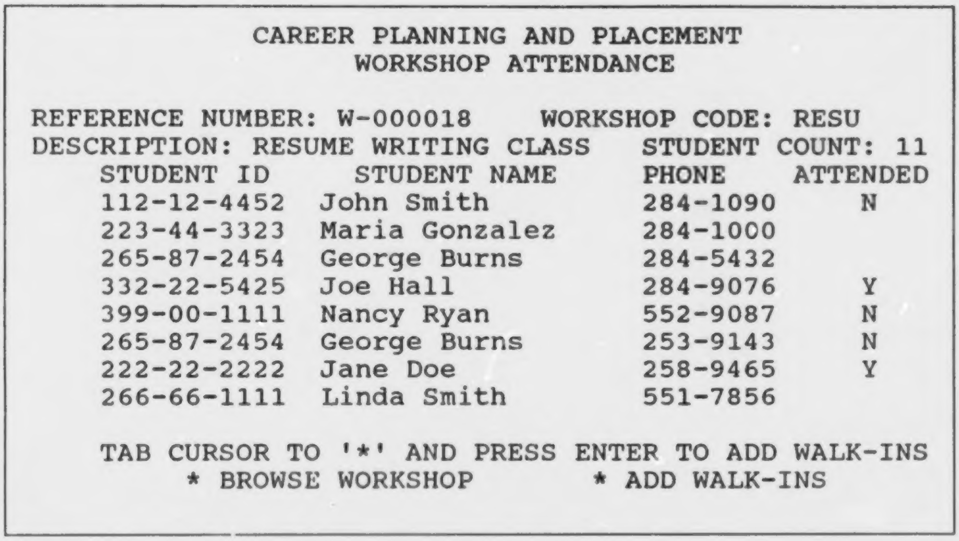
COMPANY NAME: COMPUTER SYSTEMS
POSITION: SALES POSITION              STUDENT COUNT: 11

  STUDENT ID      STUDENT NAME        PHONE        SIGNED-UP
X 112-12-4452   John Smith           284-1090         N
_ 223-44-3323   Maria Gonzalez       284-1000
_ 265-87-2454   George Burns         284-5432
X 332-22-5425   Joe Hall             284-9076         Y
X 399-00-1111   Nancy Ryan           552-9087         N
X 265-87-2454   George Burns         253-9143         N
X 222-22-2222   Jane Doe             258-9465         Y

 PRESS PF5 TO PAGE BACKWARD OR PF6 TO PAGE FORWARD
             *COMPANY NAME: COMPUTER SYSTEMS
                     TERM: 19921
```

Many companies sponsor activities to accompany their visits. All information regarding activities are entered on the administrative system. The student system offers a Browse Activity screen that allows the students to sign up for the company activities.

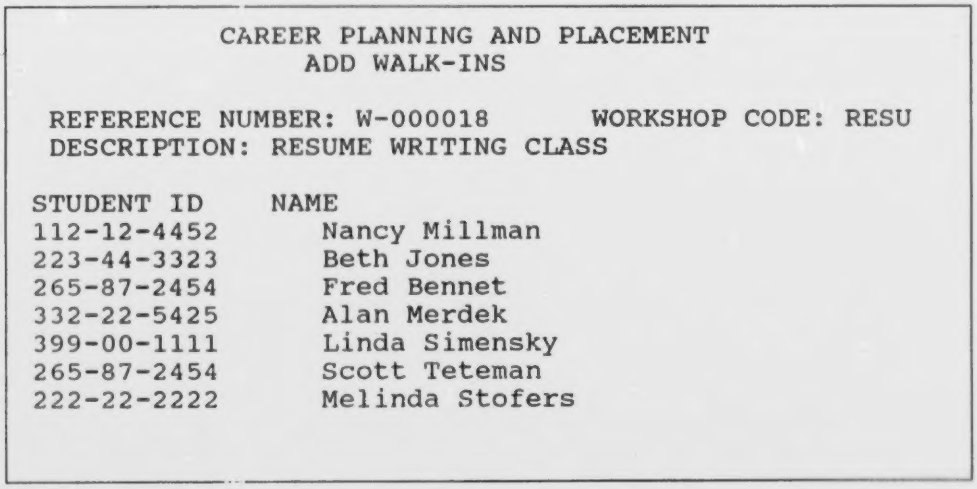
Students are required to complete a resume writing and interviewing workshop before they are allowed to interview through the Career Planning and Placement office. All workshop information is entered into the system. Students sign up for these workshops through EASY. After the workshop, an administrator must access the "Workshop Attendance" screen and mark the students who attended the workshop. If a student attended but did not sign up for the workshop through EASY, the administrator must enter these students through the "Add Walk-ins."



```
               CAREER PLANNING AND PLACEMENT
                    WORKSHOP ATTENDANCE

 REFERENCE NUMBER: W-000018    WORKSHOP CODE: RESU
 DESCRIPTION: RESUME WRITING CLASS   STUDENT COUNT: 11
     STUDENT ID      STUDENT NAME        PHONE    ATTENDED
     112-12-4452  John Smith             284-1090     N
     223-44-3323  Maria Gonzalez         284-1000
     265-87-2454  George Burns           284-5432
     332-22-5425  Joe Hall               284-9076     Y
     399-00-1111  Nancy Ryan             552-9087     N
     265-87-2454  George Burns           253-9143     N
     222-22-2222  Jane Doe               258-9465     Y
     266-66-1111  Linda Smith            551-7856

     TAB CURSOR TO '*' AND PRESS ENTER TO ADD WALK-INS
          * BROWSE WORKSHOP        * ADD WALK-INS
```



```
             CAREER PLANNING AND PLACEMENT
                  ADD WALK-INS

 REFERENCE NUMBER: W-000018      WORKSHOP CODE: RESU
 DESCRIPTION: RESUME WRITING CLASS

STUDENT ID     NAME
112-12-4452       Nancy Millman
223-44-3323       Beth Jones
265-87-2454       Fred Bennet
332-22-5425       Alan Merdek
399-00-1111       Linda Simensky
265-87-2454       Scott Teteman
222-22-2222       Melinda Stofers
```

The Student System

The student system was designed to be easy to use. The screens are based on cursor selection. The student must tab the cursor on or by the desired "button" (selection) and press enter. The following buttons are displayed on the student screens.

< HELP > - This button appears on all screens. When the cursor is placed on the "help button" and enter is pressed, a detailed help screen appears providing the student with more detailed instructions.

< PRIOR > -
< NEXT > If there is more than 1 page of information to display on a screen, next and prior buttons are displayed.

< MAIN MENU > - From most screens, the student can return to the MAIN MENU by utilizing this button.

Students can do the following in the student system:

- Browse the calendar of company visits
- Schedule interviews
- Cancel interviews
- Enter their work experience and personal data information into the system.
- Browse and schedule activities and special events
- Sign up for university workshops and special events
- View a recruiter's address after an interview.

Scheduling an interview is quick process. A screen is displayed showing all interviews that meet a student's degree and major requirements. The student selects an interview. If the student does not meet other requirements, such as GPA and citizenship status, an ineligible screen is displayed explaining why the student was not allowed to schedule for the interview.

```
        **  CALENDAR OF COMPANY VISITS **

 TO SCHEDULE AN INTERVIEW PLACE CURSOR BY COMPANY NAME AND
   PRESS ENTER

  VISIT      COMPANY NAME
  DATE       MAJORS /DEGREES REQUIRED      POSITION
  ------     ------------------------      --------
  4/25       COMPUTER SYSTEMS              SALES

             GENERAL  COMMUNICATIONS       PROGRAMMER
             CLOSED SCHEDULE

  4/28       ERNST & YOUNG                 TAX ACCOUNTANT
              OVERFLOW LIST

  4/29       ERNST & YOUNG                 TAX ACCOUNTANT
              OVERFLOW LIST
 ---------------------------------------------------------
   < NEXT >   < PRIOR >     < MAIN MENU >          < HELP >
```

```
     --JOB REQUIREMENTS--

 1. IT IS PREFERRED THAT YOU SPEAK SPANISH
 2. YOU MUST BE WILLING TO RELOCATE

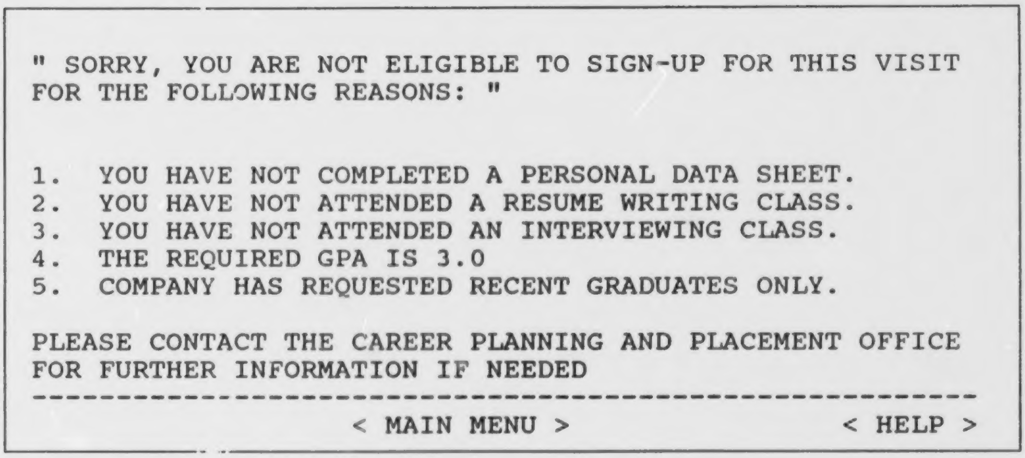
 -------------------------------------------------------
 PLACE CURSOR BY DESIRED INTERVIEW TIME AND PRESS ENTER

  9:00            9:30          10:00         10:30

 12:00           12:30           1:00          1:30

  2:00            2:30           3:00          4:00

 -------------------------------------------------------
      < MAIN MENU >                      < HELP >
```

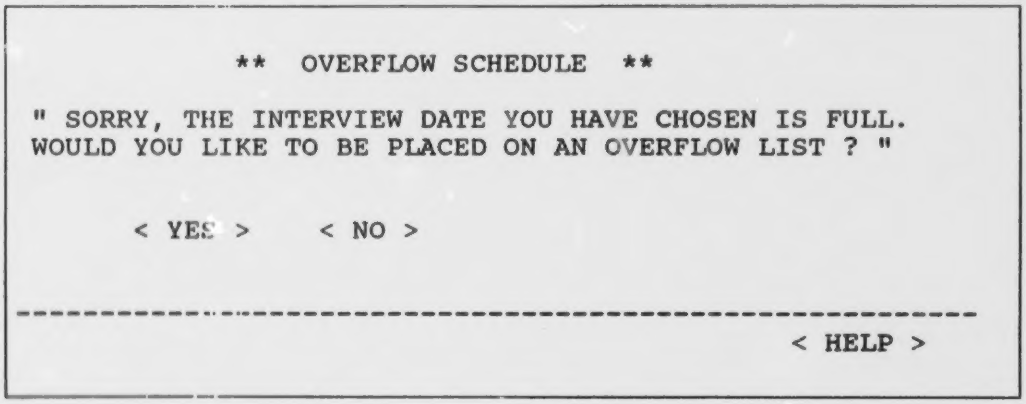


```
" SORRY, YOU ARE NOT ELIGIBLE TO SIGN-UP FOR THIS VISIT
FOR THE FOLLOWING REASONS: "


1.  YOU HAVE NOT COMPLETED A PERSONAL DATA SHEET.
2.  YOU HAVE NOT ATTENDED A RESUME WRITING CLASS.
3.  YOU HAVE NOT ATTENDED AN INTERVIEWING CLASS.
4.  THE REQUIRED GPA IS 3.0
5.  COMPANY HAS REQUESTED RECENT GRADUATES ONLY.

PLEASE CONTACT THE CAREER PLANNING AND PLACEMENT OFFICE
FOR FURTHER INFORMATION IF NEEDED
-----------------------------------------------------------
                   < MAIN MENU >                 < HELP >
```

If a student meets all the necessary requirements but there are no time slots available the overflow screen will appear. If the student is placed on the overflow list, they will be notified if a time slot becomes available.



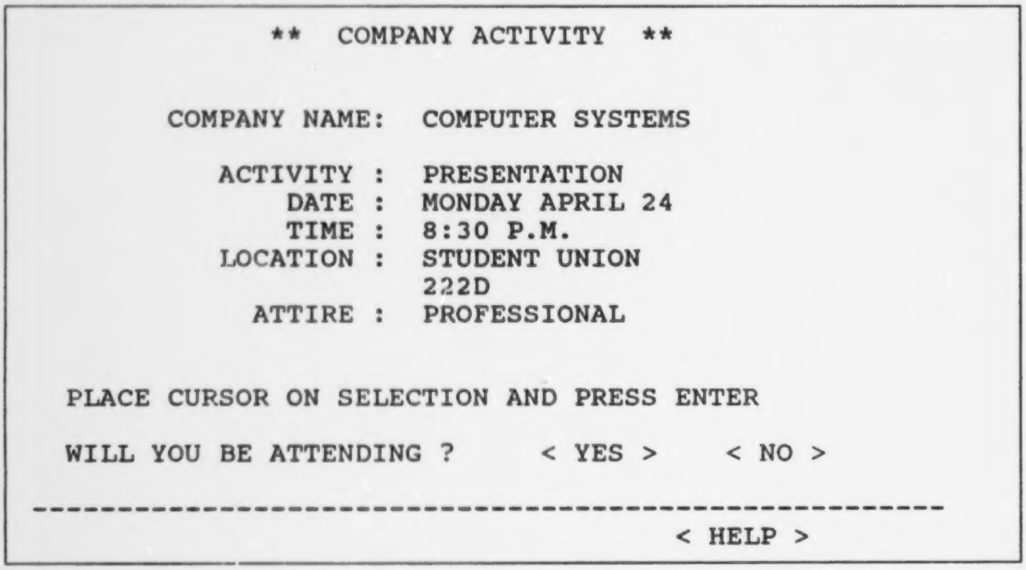
```
             **  OVERFLOW SCHEDULE  **

" SORRY, THE INTERVIEW DATE YOU HAVE CHOSEN IS FULL.
WOULD YOU LIKE TO BE PLACED ON AN OVERFLOW LIST ? "


     < YES >    < NO >


-----------------------------------------------------------
                                             < HELP >
```

If an activity is associated with the visit, the activity screen will be displayed. The student will be asked if they wish to attend.



```
                    **  COMPANY ACTIVITY  **

          COMPANY NAME:  COMPUTER SYSTEMS

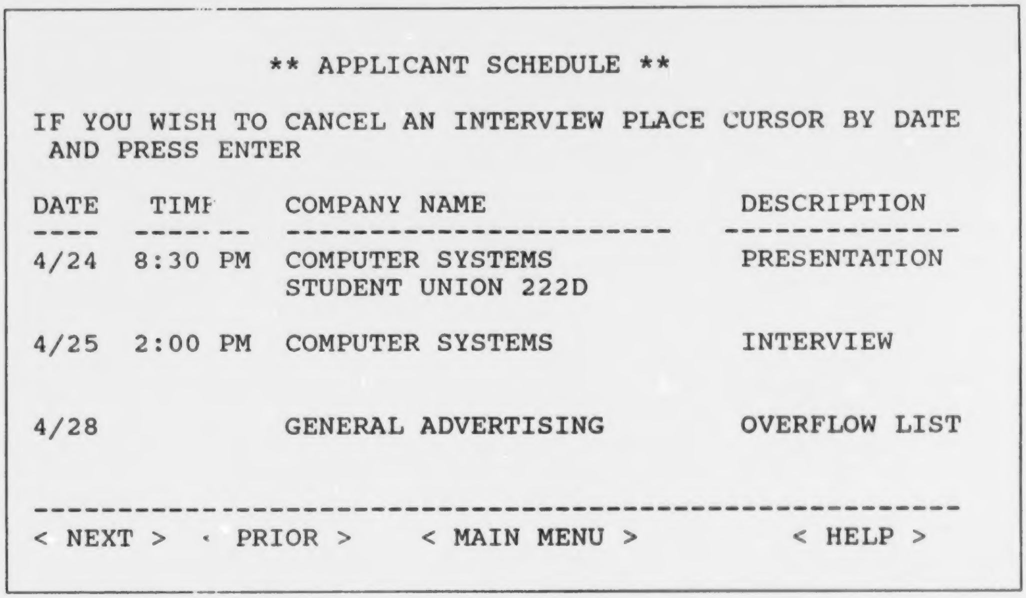
             ACTIVITY :  PRESENTATION
                 DATE :  MONDAY APRIL 24
                 TIME :  8:30 P.M.
             LOCATION :  STUDENT UNION
                         222D
               ATTIRE :  PROFESSIONAL


    PLACE CURSOR ON SELECTION AND PRESS ENTER

    WILL YOU BE ATTENDING ?     < YES >     < NO >

  ---------------------------------------------------
                                       < HELP >
```

The final screen in the flow is the applicant's schedule. The interview and activities (if applicable) will appear on the student schedule as a confirmation.



```
                ** APPLICANT SCHEDULE **

IF YOU WISH TO CANCEL AN INTERVIEW PLACE CURSOR BY DATE
 AND PRESS ENTER

DATE   TIME      COMPANY NAME                  DESCRIPTION
----   -------   ------------------------     --------------
4/24   8:30 PM   COMPUTER SYSTEMS              PRESENTATION
                 STUDENT UNION 222D

4/25   2:00 PM   COMPUTER SYSTEMS              INTERVIEW


4/28             GENERAL ADVERTISING           OVERFLOW LIST


-------------------------------------------------------------
< NEXT >  < PRIOR >    < MAIN MENU >          < HELP >
```

The student will return to the main menu to continue processing or exit the Career Planning and Placement system.

The students, administrators, and recruiters are benefiting greatly from the new system. Students can sign onto EASY almost 24 hours a day and schedule interviews. They can easily view their schedule and obtain recruiters' addresses, thus reducing the number of telephone calls in the Career Planning and Placement office.

The Career Planning and Placement office had problems controlling who signed up for interviews. Students were getting onto recruiters' schedules who did not meet the degree, major, GPA or graduation date requirements of the companies. Recruiters often left the University frustrated. The new system prevents this from occurring. Students not showing for interviews has always been a problem. By placing a hold on a student once they have missed 1 interview, and removing them from their schedule once they have missed 2 interviews, it will reduce the number of "no-shows." Since the computer verifies a student has completed the interview and resume writing workshops before scheduling an interview, an administrator no longer has to do this task.

The recruiters are pleased to know they will be interviewing only those students who meet their specifications. They also receive computerized personal data sheets and resumes. They are looking forward to having access to their schedules, student data sheets and resumes online.

Phase 2 - Analysis in progress

Job listings

Many companies are unable to come to campus to recruit our students, but are interested in having their positions advertised at the University. These job positions will be input into the administrative system. Through EASY, students will be able to browse through these job listings by majors and locations.

Part-time jobs, internships and CO-Op jobs will also be included in these listings. Companies will specify the skills needed or skills to be acquired. The student will specify the skills he/she possesses or hopes to obtain. Screens will be made available in EASY for browsing these positions by skills needed or desired. The details such as salary, contacts, locations etc will also be available to the students through online screens.

The Mentor program

The Mentor program is becoming a key program at the University. All local alumni are asked to become mentors to our undergraduate and graduate students. The mentors meet with their assigned students and share their professional experiences. Currently the mentors have only been South Florida residents. We are in the process of expanding the mentor program to include all major cities in the United States. Alumni that wish to get involved will be entered onto the database. If a student is moving to a new area, they will be able to access EASY to see if any mentors are available in the area. Our students and mentors have benefited from this program.

37th Annual College and University
Computer Users Conference

"Discover New Worlds With Technology"

M2-2

Automation of Purchasing and Financial Commitments in Princeton

Irina Rivkin
Sue Hurley
Princeton University

AUTOMATION OF PURCHASING AND FINANCIAL COMMITMENTS IN PRINCETON

Irina Rivkin
Associate Project Leader
Princeton University

Sue Hurley
Sr. Programmer Analyst
Princeton University

1. The Princeton setting

Princeton University is a private, coeducational university in Princeton, NJ, midway between New York City and Philadelphia. The 300-acre central campus is residential and all buildings are within easy walking distance of each other. Founded in 1746 as the College of New Jersey, Princeton now has an undergraduate population of approximately 4,500 students working toward the bachelor of arts or bachelor of science in engineering degree. Students come from all 50 states and from more than 50 foreign countries. A single full-time faculty of 700 teaches both graduate and undergraduate students.

The facilities and services provided by the University's Office of Computing and Information Technology (CIT) are available to all university students, faculty and staff. Mainframe computing is provided by one IBM 3090 computer running VM/CMS which are used by both administrative and academic systems. The database management system is IDMS. Online IDMS programs utilize ADS/Online, batch programs are written in PL/I and reporting is done through FOCUS.

In the financial area, all applications except Accounts Payable were written in-house by Management Information Systems (MIS), a division of CIT, due to difficulty in finding packages that could be easily integrated with the existing chart of accounts.

2. Overview of "Financial Systems"

Princeton University's Financial Systems is a term that encompasses a variety of Treasurer's Office data processing IDMS systems under development by MIS. The first system developed under this umbrella title was the Financial Reporting System (FRS). It was designed to give authorized University administrators online viewing access to the University's accounting data. Through FRS, administrators can view statements of accounts, project statements, departmental account reports and raw detail transactions.

Closely integrated with Financial Reporting is a set of systems referred to as the "Commitments System". These include Purchasing, Miscellaneous Invoicing, Interdepartmental Transactions, and Accounts Payable. The Purchasing system consists of separate applications for requisitions, purchase orders, change orders, invoices and receipts of goods. FRS reflects the current financial status of accounts, allowing the user to view both committed and spent amounts. At the moment only the Purchasing System supplies commitment information to FRS. In the future, miscellaneous invoices, interdepartmental transactions, human resources and travel will also generate commitments.

3. Infrastructure

There are several building blocks that serve as the foundation for the financial systems. These include the Vendor file, access/security tables, miscellaneous codes tables, authorization procedures and routing of electronic documents.

Vendor File

Before work on the Purchasing system began, the Accounts Payable application had its own vendor file with billing addresses. With the onset of the Purchasing system additional information about vendor's order addresses (as opposed to billing addresses) was needed. A Purchasing vendor file was created where each vendor in the file could have one or more order and billing addresses. Any new billing address or changes to an existing billing address made in the Purchasing file are automatically passed to the Accounts Payable vendor file.

At the present time, Purchasing uses its vendor file for ordering goods and invoicing. Accounts Payable uses its vendor file for payments of purchased goods, miscellaneous invoices, travel reimbursements, etc. In the future, these two vendor files will be combined into a single file which will be used by both Purchasing and Accounts Payable.

The Purchasing Office is responsible for updating its file. An order cannot be issued to a vendor unless that vendor is in the Purchasing vendor file. University departments can view the vendor file online and select vendors for their requisitions.

Access/Security

There are several levels of security checking within the financial systems:
* the user of the system must have an IDMS user ID to sign on to IDMS.
* the user must be registered to access the particular application (FRS, requisitions, purchase orders, invoices, receipts of goods).
* the user must have an application security profile which controls the actions the user can perform within the application.

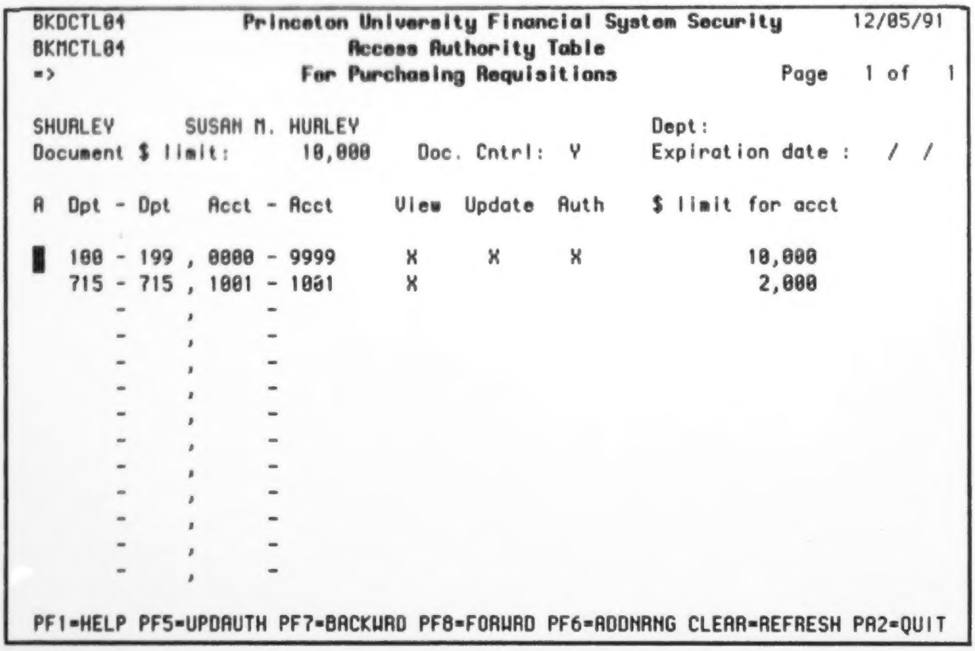
This last level of security has been developed in a generalized manner so that each financial document can be tailored to use as much or as little security as it needs. Financial documents include requisitions, purchase orders, change orders, invoices, receipts of goods, and bookkeeping transactions. Security profiles for every user of the Financial Systems are maintained by the Financial Security application. Only the security administrators of each system can update the security profiles for the users of their systems.

The Financial Security application allows the administrators to specify a user's security profile in five ways:

1. the document(s) the user can access
2. the level(s) of access (view, update, authorize)

3. the accounts which can be used in the document
4. the maximum dollar amount for the accounts
5. the maximum dollar amount for the document

As illustrated in the security profile below, the user can authorize requisitions for accounts 100-0000 through 199-9999 up to $10,000 yet only view requisitions for account 715-1001 for $2,000.



```
BKDCTL04          Princeton University Financial System Security        12/05/91
BKMCTL04                      Access Authority Table
=>                        For Purchasing Requisitions             Page   1 of   1

SHURLEY      SUSAN M. HURLEY                              Dept:
Document $ limit:       10,000    Doc. Cntrl:  Y          Expiration date :   / /

A  Dpt - Dpt   Acct - Acct      View  Update  Auth    $ limit for acct

█  100 - 199 , 0000 - 9999       X      X      X               10,000
   715 - 715 , 1001 - 1001       X                              2,000
         -   ,      -
         -   ,      -
         -   ,      -
         -   ,      -
         -   ,      -
         -   ,      -
         -   ,      -
         -   ,      -
         -   ,      -
         -   ,      -
         -   ,      -

PF1=HELP PF5=UPDAUTH PF7=BACKWRD PF8=FORWRD PF6=ADDNRNG CLEAR=REFRESH PA2=QUIT
```

Code tables

Numerous tables are maintained by users through a generalized table maintenance application. These include tables for major and minor commodity codes, object codes, units of measure, buyer codes, relationships between major commodity codes and buyers, state and country codes, and charge back codes.

Routing and worklist

Within the Purchasing system there is the concept of 'ownership' of a document: only the owner of a document can update it. However, other authorized users of the system can view this document. The owner of the document can update it, authorize it and route it to another user, who in turn becomes the owner of the document. All documents owned by a user can be viewed in the user's worklist, an electronic in-basket. The user can select a document from the worklist and start processing it. The document remains in the worklist until it is authorized or routed on to another user.

Audit trail and Comments

The system provides an automatic audit trail of all routing and authorizing actions taken on a document by creating comments which indicate who did what to the document and when the action was taken. Users can also create their own comments as a means of communicating or making notes during the processing of a document.

4. Purchasing policies in Princeton

Centralized Purchasing

The university has a centralized Purchasing Office that is responsible for handling all purchase orders over a certain dollar limit. (Quick orders, which are orders placed directly by departments, are explained later). Departments complete requisitions, either online or on paper, providing descriptions of the goods or services they want to purchase, accurate accounting information and proper departmental approval. The requisition is then sent to the Purchasing department for processing. Purchasing buyers are responsible for finding the best vendor for the requested goods, which sometimes requires a bidding procedure if the order is over $1000.

Contracts

The university has over 200 contracts with vendors. These contracts are agreements between the university and the vendor for a specified period of time. They usually consist of specific items at set prices and discounts. There are also a number of contracts for generalized groups of items where either quantity or amount discounts are available. Orders placed against a contract are called term releases. When processing a term release, the department requisitioner can view the contract online and select contract items to order.

Confirming orders

Confirming orders are orders placed by university departments with a vendor by phone or fax, without a written purchase order. The requisitioner must provide the vendor with a valid university purchase order number which is obtained through an online confirming order application (if the user has access to this application) or by calling a Purchasing buyer. To obtain the confirming order number, the requisitioner must supply valid university accounting information and the order must be within a certain dollar limit. Once the order has been verbally placed with a vendor (or faxed to a vendor), the requisitioner must still create the requisition which substantiates the confirming order. This requisition goes through the normal purchasing process and a copy of the purchase order is sent to the vendor as a confirmation.

5. Design and development of the Purchasing system

The design team

Design of the Purchasing system began in the early Spring of 1988 with a design team consisting of representatives from the Purchasing Office, MIS, and the Treasurer's Office. A committee consisting of representatives from university departments was also assembled and met occasionally to discuss and make decisions concerning topics brought up by the design team.

Design process

The design process began with the analysis of the completely manual purchasing operation that was in effect at the time. The team prototyped all the screens and reports and produced an external design document that was approved by the Purchasing department and Treasurer's Office. In this document, the existing manual purchasing process and the problems arising from it, the means of implementing the automated system, and the procedural differences between the old and new systems were discussed. Screen designs, forms, reports, hardware and software requirements, and the business rules for the automated system were also described.

In designing the database, the data analysis approach was used. Under this approach, the design team used data dependency diagrams derived from screens and reports rather than working with entity-relation diagrams.

6. Automated Purchasing process and creation of commitments

In the past, there was no mechanism for keeping track of university-wide commitment information. Some departments, however, maintained their own PC-based commitment tracking systems. These small systems were all different, each tailored to the needs of the individual department. The need for a university-wide commitments system was apparent because the university carries many sponsored projects that required tight financial control. Also, easy access to the latest commitment information would prove useful to department managers in monitoring their financial situations and provide encouragement to those departments who were reluctant to start using the automated system.

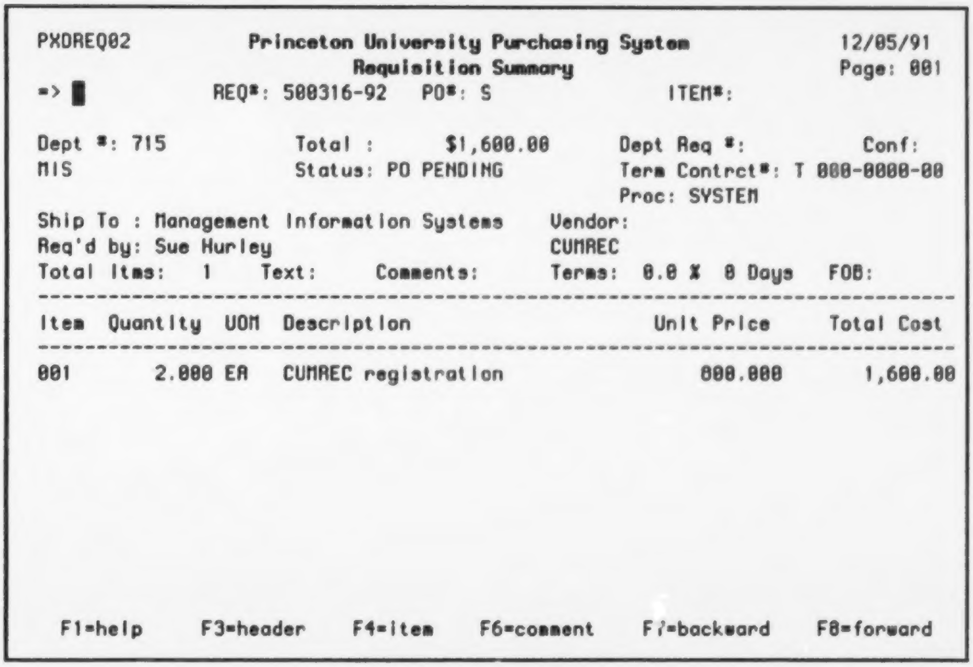
Although commitment information could be generated by the requisition, purchase order and change order applications, a mechanism for liquidating commitments was also necessary. Otherwise, the commitment information displayed in FRS would be misleading and inaccurate. The receipt of goods application provided the means for liquidating commitments. Currently, commitments are created only for departments who have access to the receipt of goods application. Commitment information can be viewed online through the Financial Reporting System.

Commitments are adjusted at each stage of the Purchasing process as described below.

Requisitions

The first step in the Purchasing process is completion of a requisition. All requisitions are entered into the online system, either by the individual department or by the Purchasing Office if the department is not online.

Princeton University requisitions consist of a 'header' , one or more items, accounting information and an authorization. The header contains vendor and ship to information and miscellaneous indicators and dates (in essence, all non-item information). For each item ordered, the system requires a quantity, unit of measure, unit price and discount, description of the item, commodity coding and an account distribution. Each item can be distributed to up to six different accounts (the limitation of six accounts is an administrative decision, not a system-imposed one).



```
PXDREQ02          Princeton University Purchasing System             12/05/91
                           Requisition Summary                       Page: 001
=> █             REQ#: 500316-92   PO#: S               ITEM#:

Dept #: 715              Total :       $1,600.00     Dept Req #:          Conf:
MIS                      Status: PO PENDING          Term Contrct#: T 000-0000-00
                                                     Proc: SYSTEM
Ship To : Management Information Systems    Vendor:
Req'd by: Sue Hurley                        CUMREC
Total Itms:   1    Text:     Comments:      Terms:  0.0 %  0 Days   FOB:
--------------------------------------------------------------------------------
Item  Quantity  UOM  Description                         Unit Price     Total Cost
--------------------------------------------------------------------------------
001        2.000 EA   CUMREC registration                    800.000       1,600.00





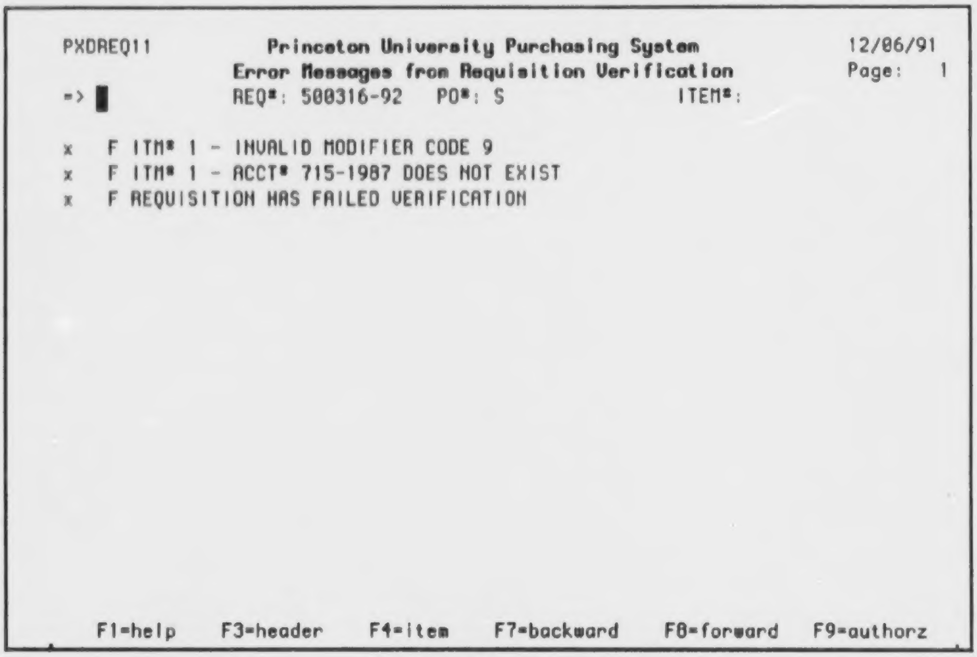


  F1=help     F3=header     F4=item     F6=comment     F7=backward     F8=forward
```

Requisition Summary screen

The requisition application also allows the user to enter begin and end text and comments, to view a summary of the requisition and to route the requisition to another user.

The requisition application provides two levels of error checking. When the user updates the data entered on the screen , the system checks the screen information for accuracy. Some invalid data can be stored and the user will be warned of this. However, prior to authorization, the user must verify the requisition and correct all invalid data that was stored during the individual update processes. The verification process does an exhaustive check of the requisition as a whole, not just individual pieces of it (ie. the header, an item, text). Errors found during verification are displayed to the user and are categorized as either fatal (F) or warning (W). Fatal errors must be corrected or authorization is not permitted. After correcting the verification errors, the user must re-verify the document. This process is continued until all fatal errors are corrected.



```
PXDREQ11          Princeton University Purchasing System            12/06/91
                  Error Messages from Requisition Verification      Page:    1
=> ▌              REQ#: 500316-92   PO#: S              ITEM#:

x   F ITM# 1 - INVALID MODIFIER CODE 9
x   F ITM# 1 - ACCT# 715-1987 DOES NOT EXIST
x   F REQUISITION HAS FAILED VERIFICATION

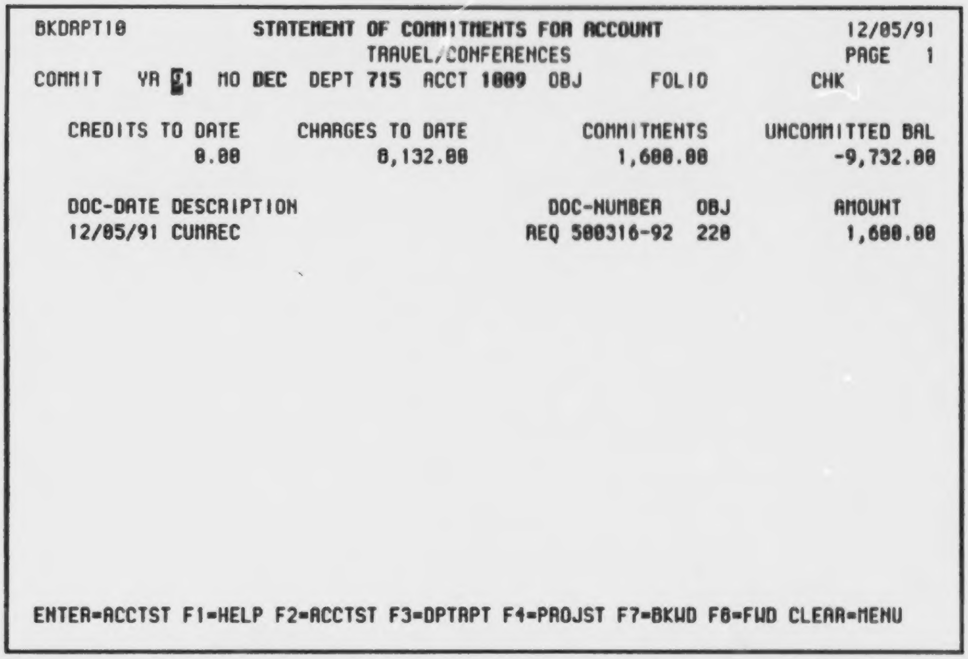



   F1=help    F3=header    F4=item    F7=backward    F8=forward    F9=authorz
```

Verification errors

Upon authorizing the requisition the system checks the user's security profile, assuring that the user can authorize the requisition for the accounts charged and that the requisition total does not exceed the user's authorization limit.

Commitments are created only for departments that do online receipt of goods. They are posted at the time the requisition is authorized and can be viewed in FRS immediately. The commitments are created for the entire document combining the distribution of all items by account-object code.



```
BKDRPT10             STATEMENT OF COMMITMENTS FOR ACCOUNT                12/05/91
                             TRAVEL/CONFERENCES                          PAGE   1
COMMIT   YR 91  MO DEC  DEPT 715  ACCT 1009  OBJ      FOLIO         CHK

   CREDITS TO DATE    CHARGES TO DATE           COMMITMENTS    UNCOMMITTED BAL
              0.00           8,132.00              1,600.00          -9,732.00

   DOC-DATE DESCRIPTION                      DOC-NUMBER   OBJ          AMOUNT
   12/05/91 CUMREC                         REQ 500316-92  220         1,600.00











ENTER=ACCTST F1=HELP F2=ACCTST F3=DPTRPT F4=PROJST F7=BKWD F8=FWD CLEAR=MENU
```

Statement of commitments for account after requisition authorization.

Purchase Orders

Once the requisition is authorized, the purchase order is created by the system and routed automatically to the appropriate buyer, according to the commodity codes of the requisition items. It will appear in the buyer's worklist. The buyer can update any information on the purchase order or route it to someone else within the Purchasing Office. The buyer can also disapprove it, in which case it is sent back to the authorizer of the requisition and the current commitments for the requisition are deleted. Processing of the purchase order is similar to requisition processing. The buyer must verify the order for accuracy prior to authorizing it. Upon authorization, the purchase order is printed in the Purchasing Office on a laser printer and copies are sent to the vendor and the requisitioning department. Along with their copy of the purchase order, university departments also receive an account distribution form.

At the time of purchase order authorization, adjustments to commitments may be necessary if prices or accounts were changed or items were added to or deleted from the order. At a minimum, commitment information is changed to reference the purchase order number instead of the requisition number.

Quick Orders

Quick orders are purchase orders which are processed and authorized by the requisitioning department, with no intervention from the Purchasing Office. To be converted into a quick order, the requisition must meet certain criteria: it must be under a certain dollar limit, it must not need approval by the Office of Research and

Project Administration (ORPA) or the Office of Health and Safety (OHS) and,the security profile of the requisition authorizer must include the ability to authorize purchase orders. Quick orders greatly reduce the workload of the Purchasing Office in that the buyers do not need to spend their time processing small and inexpensive orders.

At the time of requisition authorization, the system checks if the requisition meets the criteria to become a quick order. If so, the user is given the choice of converting the requisition into a quick order or sending it to the Purchasing Office for processing. If the user decides on a quick order, the system authorizes the requisition as a purchase order, assigns a purchase order number and the purchase order is printed and sent to the vendor. If the user does not want a quick order, the requisition is processed in the normal way, as explained earlier.

Change Orders

Change orders are normally initiated by the requisitioning department when they want to add to, delete from or modify an order which has already been issued to the vendor. In certain instances a buyer may initiate a change order. As with requisitions, the department must enter all the change order information, verify it for correctness and authorize it. The change order is then automatically routed to the buyer assigned to the purchase order. The buyer reviews the change order, makes any necessary modifications and authorizes it. If the changes affect the vendor, a copy of the change order is printed and mailed. The requisitioning department also receives a copy and an updated account distribution form.

As with purchase orders, adjustments to the commitments may be necessary.

Invoicing

Vendors send their invoices to the Purchasing Office where they are entered through the online Invoicing application by invoice clerks. The clerk displays the purchase order online and selects the items that are currently being invoiced. If necessary,the clerk can make changes to the item quantity, price and discounts to agree with what is being invoiced. Also available is a means to add new items which are on the invoice but not on the purchase order. The online invoice should be an exact replica of the paper vendor invoice. A charge back may be created if invoice item price(s) exceed a defined variance of 10% or $100.00. The charge back indicates the price the university will pay to the vendor. Like purchase orders, the invoice is verified for accuracy and authorized by the Purchasing Office.

At this time, not all departments are doing online receipt of goods. Upon invoice authorization, the system checks if the requisitioning department is receiving online, and if so, automatically routes the authorized invoice to the appropriate person in the requisitioning department. If the department is not online, the invoice is printed on a laser printer in the Purchasing Office and mailed to the requisitioning department. These offline departments review the paper invoice, authorize it and send it to Accounts Payable for payment processing.

Receiving

Princeton University does not have a centralized receiving department. Vendors deliver goods to the 'ship to' address indicated on the purchase order. In actuality, the

29

receipt of goods application is a system of allowing the departments to authorize an invoice for payment. The requisitioning department is receiving against a vendor invoice.

For departments that are receiving online, the electronic invoice authorized by the Purchasing Office appears in the worklist of the person who must process it. This person can view the invoice and charge back all or part of items for which should not be paid (in case of damaged goods, goods not received, overshipments, etc). The person cannot make any changes to prices or discounts or add items to or delete items from the invoice - this may only be done by the Purchasing department. If such changes are necessary, the department processor must route the invoice back to the Purchasing Office. Once satisfied with the invoice, the department verifies it for accuracy and authorizes it.

At this time, the purchase order may be updated (due to pricing, discount, or account distribution changes) and a 'request to pay' transaction is written to the Accounts Payable system. Payments may not be made for several days, however commitments are fully or partially liquidated, University accounts are adjusted immediately for the liquidated amount, and these transactions can be viewed through the Financial Reporting System. Once the payment is actually made, the check number is added to the detail accounting transaction.

7. Implementation of the University-wide system

Strategy

Coding of the Purchasing system began in the late Spring of 1989 and is still going on. Applications were delivered to the users in phases.

The basic strategy in releasing the Purchasing system was to start in one central office. The requisitioning system was turned over to the Purchasing Office in the Fall of 1989. A handful of clerks data-entered the paper requisitions sent in by departments. The paper requisition forms had been redesigned to accommodate the new system and all departments were required to use it. MIS programmers spent time in the Purchasing Office monitoring their progress, helping them to understand and use the system. In this way, the programmers were able to see first-hand any problems and confusions encountered. The Purchasing Office also used the Financial security and the Codes Table Maintenance applications.

Shortly after introducing the requisition system, the vendor maintenance application was released to the Purchasing Office. While Purchasing clerks were loading the vendor file, Purchasing buyers were introduced to the purchase order application. Again, by working with a small group of users, MIS programmers could easily monitor their progress. Purchase orders were printed on a laser printer located in the Purchasing Office.

These applications were used and tested by the Purchasing Office through the summer of 1990. At this time, the change order application was also delivered to the Purchasing Office.

By October of 1990, all applications (requisitions, financial security, code table maintenance, vendor file maintenance, purchase orders, change orders) were moved to production. With the delivery of the Invoicing application in July of 1991, the Purchasing Office became fully automated.

University departments did not start coming online until January of 1991. Again, the strategy with bringing departments online was to start with a small number of departments. The first departments were selected by the Treasurer's Office based on the volume of requisitions processed and departmental interest in the system. Currently, departments are working with the requisition, change order and receipt of goods applications. They also have applications which allow them to view commitment information through the financial reporting system and to view purchase orders.

Documentation

Online documentation for the Purchasing systems is available for each screen within each application. The user of the application needs only to press the F1 key from the current screen to read this documentation. MIS, in conjunction with the Purchasing Office, produced a hardcopy user manual for the departmental requisitioning application. The users receive manuals during their training session.

The documentation group within MIS is currently working on a user manual for all Financial Systems.

Training

Responsibility for training the university departments was assumed by the Purchasing Office. As departments are introduced to the system, one or two representatives from the Purchasing Office meet with the department to discuss their administrative setting. They then train the designated department personnel in the use of the system on an individual basis. If the need arises, they may be called back for more advanced training.

The University also provides short introductory classes covering both FRS and the Purchasing systems as part of its educational series provided by CIT. These classes are taught by representatives from the Treasurer's Office and the Purchasing Office. Any interested university personnel may attend them.

Downloading to PC

Some departments, who have their own PC-based management systems, are able to download purchasing information about their department from the mainframe into their system. These departments can run the download on demand. The download enables the departments to incorporate central university data with their local data for more accurate and timely reports.

Archiving

Twenty-four months' worth of data is available online in the Financial Reporting System. The purchasing system is also designed to hold information online for 24 months. Documents older than this will be archived with reporting capabilities.

8. Conclusion: Successes and problems

The Princeton University Purchasing Office processes approximately 30,000 purchase orders and 36,000 invoices a year. Currently about 20% of the university's departments are using the system accounting for 84% of the total volume of requisitions. There are more than 200 users registered with security profiles and the number is growing. There has been a positive response to the system among the current users.

Both the Purchasing Office and the online university departments have reaped many benefits from the Purchasing system. The major benefit to the Purchasing Office is that their personnel now have more time to concentrate on Purchasing-related functions rather than clerical functions:

- time needed for data entry of requisitions has been greatly reduced since departments themselves now enter 84% of their requisitions online
- the manual typing of purchase orders has been replaced by laser-printed purchase orders
- the Purchasing Office does not handle quick orders, however the information about them is now stored in the database and can be viewed online
- the number of phone calls to the Purchasing buyers from departments requesting confirming order numbers has been greatly reduced since departments can now get these numbers themselves through the confirming order application.

Additional benefits to the Purchasing Office include:

- the ability to set up contracts based on statistics from the accumulated data
- vendor and departmental inquiries can be answered faster and more easily
- more accurate and timely reports

The major benefits to University departments who are online include:

- the ability to view and monitor their purchasing commitments online
- easy tracking of the progress of their orders through either the requisition application or the purchase order view application
- better payment control through the ability to quickly check previous payments against the purchase order
- the ability to create individualized FOCUS reports against purchasing information by designing the reports to meet their own particular needs

A number of obstacles were encountered along the way. These problems include:

- departments with their own automated systems had to duplicate their efforts until they were fully integrated into the central purchasing system
- fear of computers for non-computing departments
- the University community did not welcome changes
- implementation was done in stages. The departments could not benefit from the commitment information until the receipt of goods application was released
- the growing number of contracts makes the process of contract selection time consuming

On the whole, requisitions are placed and orders are issued in a more secure and controlled environment due to online security checking. By using the Purchasing system, departments have shortened the processing time necessary to place an order with a vendor. Documents are routed electronically and do not have to go through the campus mail system. As departments are introduced to the receipt of goods system, the amount of time taken to process and pay an invoice is also be reduced, which in turn means more timely payments to vendors. Shorter turn-around time for invoice payment also allows the departments to take advantage of vendor payment discounts.

Despite some initial resistance from manual departments, the Commitments and Purchasing systems are now widely accepted and utilized throughout the university. The implementation of these university-wide online systems have proven to be a great success!

37th Annual College and University
Computer Users Conference

"Discover New Worlds With Technology"

M2-3
Visions of Future Student Information Systems

Gene Sherron
Florida State University

Visions of Future Student Information Systems

Gene T. Sherron, D.B.A.
Associate Vice President for Computer & Information Resources
Associate Professor of Information & Management Sciences
Florida State University

Background

As a part of the strategic planning process, it is important to back away from day-to-day activities and dream about what possible changes can be made to enhance administrative computing utilizing new and future technologies. Developing such "*visions of the future*" should be done without the constraints of a current year budget. Yet, proposals should be realistic enough to excite implementation because they reveal cost-effective alternatives compared to the current systems.

Focus

The four major areas, generally referred to as the Student Information System [SIS] (i.e., Admissions, Advising, Financial Aid, and Registration) were selected for consideration because the SIS is a somewhat self-contained system. And, it is an area that offers considerable promise for improved effectiveness and efficiency through the application of new technology.

ADMISSIONS

THE ADMISSIONS PROCESS

There is no "typical" admissions system. Universities are as individualistic as people. Thus, there is no "accepted standard" for the conduct of the admissions process. To describe the admission process, a generalized system of admissions is used. In the simplest sense, the functions of admissions are: *standards* for admissions; the *recruitment* process; the *application* process; *evaluation* of applications; *notification* of applicants; *management* of the process; and *transfer* to registration.

PROBLEMS COMMONLY ENCOUNTERED IN THE PROCESS

Most admissions systems function adequately. Were this not so, the institution would not operate well and/or soon go out of business because admitting students is at the heart of the system. Thus, the problems are at the margin and most often have to do with refinements that would lead to improved effectiveness (i.e., yield rate) or efficiency (meaning the productivity of the staff as affected by work flow and computer systems).

Early Identification of Students

Colleges and universities seek to enroll the best possible students. In this case, "best" usually refers to the student most likely to succeed in the particular educational setting of the institution. Therefore, admissions officers try to find these better students as early in the process as possible. It has become common practice for admissions offices to start a dialogue with 9th Graders who show real academic promise. To illustrate this phenomenon, it is not unusual for a high school student, who does well on PSAT/NMSQT, to receive over 100 pieces of unsolicited mail from colleges and universities in April and May of his or her junior year. Handling the volume of mailing activities, not to mention its cost, is a significant labor expenditure for admissions offices. For the highly desirable students, 18 to 24 items/mailings will go out over a three-year recruitment "campaign."

The admissions officer's worst nightmare becomes a reality on the rare occasion when the discovery is made that a National Merit Finalist, the child of a prominent alumnus, and a talented minority student all enroll at a competing institution on the very same day just because they somehow slipped through the crack.

A Question of Resources to Achieve Goals

In any organization, there are never enough resources to assure that all goals are met. The organization of admissions materials, storage, and retrieval of admissions documents, notification of and correspondence with applicants, visitations, and the like can consume significant resources with uneven results. How much is enough and how much is wasteful?

Managing the Admissions Operation

On a day-to-day or week-to-week basis, the Admissions Officer must keep track of the process and apply "mid-stream" corrections to the activities in an attempt to improve goal attainment. This need requires that data be maintained, compared to goals, compared to state and national trends, and actions on adjustments applied. Some of these activities can be automated while others are accommodated through intuitive judgments.

Pushing the Paper

Much human effort goes into the processing of such items as applications and letters of recommendation. The admissions office is a sea of paper. Hundreds of pieces of mail arrive daily, are opened, routed, entered into the computer, and stored or shredded. On a periodic basis, admissions officials review the file -- paper and electronic. This is a costly activity in terms of the staff time spent in processing the files through the faculty and tracking these files in a timely manner. For instance, four admissions officials are devoted to this process throughout the year. It takes ten minutes for an admissions official to calculate the GPA based on specified courses and evaluate the application or over one and a half man-years of effort.

APPLYING EMERGING TECHNOLOGIES TO ADMISSIONS

A Distributed & Friendly System

There is a growing interest on the part of managers to control their own system. Requesting jobs to be run, modifying reports, or changing parameters on outputs continues to be a cumbersome process for users as they try to understand the typically unfriendly nature of programs associated with host-based application software. Yet, the concept that "no man is an island, entire of itself" certainly applies to student information systems. In addition to the *flow of data* from admissions to financial aid to housing to orientation to registration to accounts payable to health records to advising to alumni, there is an almost start-to-finish interrelationship that requires an *integrated* information system.

Universities need off-the-shelf software to link mainframes transparently into client/server networks. Such *user-friendly software* would feature pull-down menus, windows for multiple sessions, icon/mouse driven software, pre-defined screens for data input and manipulation. This type of software would be designed to optimize the *client/server environment* such that powerful workstations and servers would be located in the Admissions Office but linked to the mainframe where *database management systems* (DBMS) and system management functions take place.[1] In this manner, computing is moved down to the departmental and distributed levels yet powerfully integrated to the university's relational database/*system query language* (SQL) standard of administrative computing.

Recalling that the Admissions Director must work closely with the Committee on Admissions to develop annual parameters for admissions criteria, a relational DBMS with SQL-based access to the data could be provided by *Executive Information Systems* (EIS). PC-based EIS packages are becoming available that will run on a *client/server PC LAN* that is linked to the host as a mainframe-based cooperative-processing product accessed through an SQL server.[2] Additionally, these systems could provide graphical presentations to assist in modeling the admissions criteria.

Instantly, An Electronic File

The powerful but distributed system just described would have intelligence built into it, through an *expert system* approach, would cause the creation of an individual applicant's "pre-application record" as the result of the first electronic "document" or transaction that comes in from any source--a dump of the SAT or ACT tapes, a phone call from an alumnus, or FAXing an application to the Admissions' 800 FAX number. The technology exists to make the admission's application process a *paperless process.*

Additionally, the *expert system* software would monitor the student's file as it develops. When such a *data interpretation system* determines that certain item(s) are required to complete an applicant files, the system would automatically generate a letter to the applicant requesting the item. But, the ideal paperless approach would be for the system to send an electronic mail or E-mail message to the high school asking the student for the missing item. In truth, a simple step such as making a mailing label on demand would please most admission people.

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[1] Jeff Moad, "Can Big Blue Reposition Big Iron?" Datamation, February 1, 1991, pp. 54-60.

[2] David Stamps, "EIS Prices Finally Get Real," Datamation, January 15, 1991, pp. 65-66.

National E-Mail

The concept of sending *Electronic Mail* (E-mail) to prospective students need not be limited to Florida. Assuming the use of national networks and addresses provided by out-of-state students, such E-mail reminders and "correspondence" should continue to grow in acceptance and economy.

Smart Mailings

We know that the first mailing to busy high school students must be bold and distinctive to get their attention. And, a "smart" (expert) system is needed to keep track of a university's mailings so that prospects receive neither too many nor too few mailings. So, another *expert system* needs to be running in such a manner as to make a daily review of files to determine the types of information that need to be sent to the prospect to encourage application and/or acceptance.

A "Floppy" Application

Another alternative would be for universities to send out their application materials on a floppy disk. Then, the prospects could browse through information found on the floppy to learn about the applications process, catalog information about majors and courses, and financial aid opportunities. To apply, the prospect would send the completed application on the floppy back to the university in its franked, self-addressed mailing envelop. Drexel University is sending out 50,000 floppies (MS-DOS) to their prospects so they can learn about Drexel and complete the application process on their home computer.[3]

A Speedy Acceptance

Seventeen-year-olds lead busy lives at intense emotional levels. Some make their college selection decision based on the first acceptance received. Others wait until all the "offers" are in. Recognizing those are the two extremes, it is none the less critically important for universities to get acceptances out as rapidly as possible.

The "smart" admissions system will be designed to cut the six-week's procedure for preparing student application files in half. A quicker acceptance notice to the best and brightest students in the application pool increases the chances that these students will attend Florida State rather than a competitor.

Imaging

It is reasonable to apply *imaging technology* to some of the software described above. For instance, applicants could send in a paper form which, upon receipt in an admission office, would be scanned into the system. This same scanning would apply to other paper materials relative to the process (i.e., high school transcripts, letters of recommendation, acceptance letters, etc.).

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[3] "Computer Notes," The Chronicle of Higher Education, January 23, 1991, p. A17.

The "Expert" Evaluator

In the friendly software described earlier, it will be important to build into the design as many *expert systems* as possible. In addition to the overall "intelligence" of looking for a complete applicant file, there must be an expert system component that computes the high school GPA based on the "approved" courses for admission to the university.

"Charge" My Application Fee

Another electronic opportunity comes to mind with regard to the transmission of the application fee. Many universities presently accept credit card payments for tuition and other fees. So, as an extension of this concept, a system could be developed that allows the prospect to call the university's 800 number (or a 900 number in tough fiscal years) and direct a fee payment via a major credit card. The acknowledgment number can be provided to the student for entry into the university's electronic application form or the university operator should be able to enter the fee payment into the admissions system as well as that of the controller/comptroller/bursar.

A Voice Response Application

Voice response units could be used to communicate (both ways) with the student concerning the admissions process. Properly tied into the proposed admissions' software, an *expert system* would evaluate the application materials on an ongoing basis and build a file of those that are incomplete. Then, the voice response system software could poll the admissions system for a file of applicants that needs to be called. The calls would be made automatically (like operatorless, automatic telemarketing systems) using "scripts" that advise the applicant of the need to submit the missing items. And, it would be a nice touch to let the applicants know when all materials had been received and that they can expect to hear about an admission decision on or about such and such date. In a like manner, students could call the university voice response unit's 800 number and request the status of their application, using a Personal Identification Number (PIN) for security. So that this process does not become totally automated and perhaps impersonal, a "real" letter of acceptance should always be sent to the applicant.

Once the admissions decision has been reached, the applicant could be taken to the next step of scheduling a campus visit as part of the Orientation Program. During Orientation, new students are advised on registration and allowed to register themselves for the first time using the touch-tone telephone registration system.

The Admissions Bulletin Board

Another variation on the use of a voice response unit to communicate with prospective students would be an *electronic bulletin board.* With the growing use of personal computers, many questions could be asked by high school students and their parents through a link to the university. This access could be made from the high school or from home, using the university's 800 number. Admissions officials could respond to these questions on-line and interactively by posting them on the bulletin board and even address a personal note to the student.

Interactive Video

There tends not to be too much demand for applicants to "sell" themselves in a personal, visual manner such as a video tape. On the margin, however, some students and universities might benefit from a video presentation on the part of the student. On one end of the spectrum, this would be true for students who were trying to be accepted as exceptions to the minimum numerical standards. On the other end, there are bright and talented students who are seeking to optimize their scholarship opportunities. So, in these cases students might be allowed/encouraged to "meet the admissions committee" via video tape or *teleconferencing*.

A real need exists for admissions officers to "sell" their university to each and every high school in the state several times a year. In the best of fiscal times, admissions staff can make only a few trips a year. Thus, *video/teleconferencing* offers a real opportunity for the university to present its "face" to prospective students.

ADVISING

A BRIEF DESCRIPTION OF THE ADVISING PROCESS

Students throughout the U.S. have been completing their degree requirements on a self-directed basis for years as a part of their "liberation" dating back to the Vietnam era. Typically, when a student thinks s/he is close to graduation, s/he asks for a "graduation check." This is often the first time the student's courses are compared with the list of requirements for graduation. All too often these checks are made after three years of course work. Belatedly, the student learns that s/he may or may not have followed the most direct path to degree.

Over the years, parents and university administrators have been bothered by the obvious inefficiencies of such a laissez-faire approach to schedule planning. Yet, most agree that it is appropriate that students should be allowed the freedom of planning their own academic program. Thus, various systems have been developed in the last two decades to provide the student more assistance without appearing to be usurping the student's prerogative.

The Concept of Advisement

The concept of advising begins with the premise that a university offers degree-oriented curricula that, when accomplished through course work, lead to the granting of a degree. Putting this concept into practice, colleges and universities publish annual catalogs or bulletins which, among other things, spell out the "requirements (courses) for students majoring in. . ." The catalog published in the year of an individual's matriculation becomes the "contract" for that student's education. The balance sheet, used by students to track their performance (compliance) against the university's contract, is the transcript.

As a practical matter, most students do not understand this contract concept much less call for a copy of their transcript for comparison with the catalog's requirements for degree completion.

PROBLEMS COMMONLY ENCOUNTERED IN THE PROCESS

Student Attitude

As a generalization, students have a tendency to evidence very little concern in planning their curriculum strategy, other than for the upcoming semester. Yet, when a student believes himself to be within a semester of graduation, matters get serious and tense. The usual question is, "Why didn't you tell me?"

Faculty Participation

An entire generation of faculty members has grown up without the feeling that they have responsibility for advising students about curriculum. Certainly, the faculty is interested. But, the notion of sitting down with a student to check, compare, and evaluate each course with the degree requirements of the relevant university bulletin was not high on the list of things the faculty would most like to spend time doing.

Validation of Transfer Credits

The mobility of our society is evident in colleges and universities as students move from state to state and city to city. Whether or not courses taken at one institution can be transferred to another is the prerogative of the admitting institution. More specifically, it is up to the faculty of the respective discipline to make the equivalency determination.

APPLYING EMERGING TECHNOLOGIES TO ADVISING

A Bee-line to Graduation

Many variables come into play as students attempt to map out the optimum timing of course work from matriculation to graduation. For this reason, few students bother with schedule planning beyond one or two semesters in the future.

Using historical data and current student demand, it would be appropriate to introduce an *expert system* module that generates a *critical-path analysis* to graduation. This system would allow the student to visualize the optimum sequencing of courses to the completion of requirements for a degree. Several benefits accrue from such a "straight-line" approach. First, the student would be sensitized to the hard-to-schedule courses on the path to graduation. Secondly, the department chair would be better able to project demand, based upon the compilation of these critical path runs and then modify the offerings to best suit the students' planned curriculum.

A National Common Course Numbering System

Sufficient agreement exists to suggest that, on a national basis, colleges and universities could develop a *national common course numbering system*. To implement such a system, institutions would need to exchange catalogs/bulletins for faculty evaluation of various courses. This exchange could take several forms. Presently, most catalogs/bulletin are printed from magnetic tapes as outputs from a system maintained by registrars. These tapes could be electronically transmitted, upon request from a collaborating college or university. Or, it might be more desirable to exchange optical disks of catalog materials.

Statewide, On-line Advisement

The Florida's State University System (SUS) advising system referred to as the Student Academic Support System (SAAA) is up and running at all nine universities. Florida's twenty-eight public community colleges have their own advising system which is soon to be linked to the SUS system. Since all of the student transcripts are in electronic files, what is missing is the software to bring those data into a system of comparison with the various universities' curricula files. Presently, all of the state institutions have the hardware for access (counselors' terminals) and communications to link them. To implement a SASS system on a state-wide basis, only software and training are needed. Were this to occur, students could use SASS throughout the state and enroll for courses at any Florida higher education institution with more confidence that each course would become an acceptable part of the home institution's degree program for that student. There are academic and other reasons, such as residency requirements, that suggest that this should not be a completely automatic process.

State-Wide On-Line Advising

Another concept that would personalize this electronic system would be the incorporation of a *menu-driven, query module*, along the lines of SQL, which would allow students to interact with the admissions offices. Electronic advising has the potential for being impersonal. So, an attractive feature of the system would allow the student to send an *E-mail message* to the university to learn about the fit of a particular course.

FINANCIAL AID

A BRIEF DESCRIPTION OF THE FINANCIAL AID PROCESS

The financial aid system provides funds to those students who otherwise could not afford to attend college. In addition to providing monies on the basis of demonstrated financial need in the form of grants, work awards, and loans, universities offer scholarships to recognize and reward talent, academic achievement, and meritorious performance.

The financial aid program is one of the largest fiscal operations of a university. In 1992, 22,000 applications competed for $63 million in aid at Florida State. Over 14,000 awards were made by the start of the school year. This distribution process required the handling of over 80,000 documents.

The Application Procedure

In the January before the Fall semester, a student begins the financial aid application process. All applicants must complete various forms from which their financial need is to be calculated. These range from the Family Financial Statement (FFS) to the Financial Aid Form (FAF) to the parent's income tax forms. These materials must appear overwhelming to a 17-year old.

The Allocation of Financial Aid

The "packaging" process begins early in the calendar year when a faculty committee determines the gross financial aid that will be needed by the different categories of students -- undergraduates, graduates, student athletes, part-time students, special students, and nonresidents. Estimated budgets for all of the different categories of students mentioned above are developed and published annually.

These budgets represent the "allowable educational cost for the academic year." The amount of a student's financial need is determined by subtracting the expected family contribution and other outside resources from the respective student's budget.

Funds Management

As mentioned earlier, the goal of the Director of Financial Aid is to "spend the budget." Before the Fall semester starts each year, almost all of the available funds are "offered." From that point on, the Office of Financial Aid works to commit all funds that are not accepted by students.

However, students also start in the Spring and Summer semesters. So, the financial aid cycle is continuous and overlapping. And, with each new year, there will be procedural changes caused by modifications to federal income tax forms, need-analysis forms, and federal and state financial aid programs. Thus, each year is truly a "new" year in terms of the forms, the process, and the schedule of semester cycles.

PROBLEMS COMMONLY ENCOUNTERED IN THE PROCESS

A Dynamic Process

At Florida State the financial aid process has become a highly automated system. But, its dynamic nature gives one the impression that the application software never reaches "maturity" in the sense of a systems development cycle. This then is the basic problem with the financial aid software across the country, ever changing and always playing catch-up. Consequently, the principal software attribute needed in financial aid programming is flexibility.

Establishing an Applicant Record

Typically, individual student records are created by the keying-in of the appropriate data from the FSU Financial Aid Application as they arrive in the daily mail. This volume is compounded by the fact that each students sends in an average of eight documents. During the peak months of January through April, about 20,000 pieces of mail are received each month. Keying-in these data amount to six man-years of effort annually.

Award Notification

Since the need analysis, like national educational testing (SATs, ACTs, etc.), gives an index that is based on equity, Financial Aid Officials proceed to make awards as soon as individual applications are complete. The award packages develop rather logically as a combination of grants, if qualified, loans, and/or employment awards. Florida State's home-grown software programs automatically generate these award packages and even include the laser printed award letter, complete with the Director's signature.

APPLYING EMERGING TECHNOLOGIES TO FINANCIAL AID

User-Driven Software Modifications

Since all colleges and universities must have a financial aid program, they need some type of computerized system to manage the process. And, since all of them are heavily driven by the federal involvement in the program, it might be possible to develop a package of *user-friendly software* that would have universal application. This idea stems from the notion that within most financial aid offices, there typically exists a *systems interface principal* who knows the functions of that system in sufficient detail to suggest or even make certain annual "adjustments" to the software.

An Electronic Financial Aid Application

As suggested earlier in the Admissions section, high school students could complete and transmit their financial aid application from a workstation in their counselor's office. This *E-mail financial aid application* would be accomplished through state-wide networks. Alternatively, students and parents might accomplish all of this at home using a dial-up connection to an 800 number using a PC or FAX.

In addition to speeding up the process, this approach "distributes" a mundane keystroking function down to the lowest level (and out of the Financial Aid Office) and it improves the data integrity by placing data entry at the source.

The next day (or possibly the same day the student completes the electronic application) a Financial Aid Officer would begin to evaluate this "electronic package" for completeness. As necessary, an E-mail message could be sent back to the high school requesting other forms, have errors corrected or provide missing information. This new procedure would not only save postage, but cut out much of the human and computer costs associated with generating and mailing letters. By the way, the annual cost of Florida State's mailings, in postage alone, is $175,000.

As far as keeping track of such interactions, the proposed software should have an *expert systems* nature so that an automatic notation would be made in the student's growing electronic file. The system could also, if necessary, generate an E-mail message, as a follow-up reminder to a tardy response or as notification that all materials are in and the evaluation should be completed by such and such date.

Imaging the Tax Forms

A major component of the financial aid application package which doesn't lend itself to being keyed-in from the high school is the Federal income tax form. One solution might be to transmit them by *FAX*, if the high school has a FAX machine.

FAX technology is just around the corner that will allow a *PC-FAX machine* to be used on the receiving end to move the image in digital form directly into the host computer.

The Financial Aid Bulletin Board

As part of the dissemination of the information process concerning aid, grants, and scholarships, the university could develop an ***electronic financial aid bulletin board*** to keep high school and community college students informed regarding the latest changes.

Interactive, Touchtone Phone Communications

Hundreds of universities have installed ***touchtone telephone registration systems***. Such systems tend to have peaks and valleys of usage. But, in any event, the financial aid process represents another good candidate for such an inquiry system. To appreciate the potential for such a system, the FSU's Office of Financial Aid presently handles over 7,000 incoming and outgoing calls a month. Such an automated system will reduce the amount of time staff members are on the phone and allow them to organize their work to deal with groups of similar types of activities.

Much like Sears, this same system could be used to call students to notify them that certain actions have taken place or that certain steps are lacking on the student's part.

REGISTRATION

A BRIEF DESCRIPTION OF THE REGISTRATION PROCESS

The Registrar is responsible for registering students and for maintaining student and departmental records. The Office of the Registrar is the official custodian of permanent academic records for the University and performs those administrative functions relating to graduating students. These include such activities as: securing, preparing, maintaining, and disseminating records; implementing, administering, and monitoring academic regulations; and providing services and information to faculty, staff, students, and the public. It is also the official source for student academic transcripts.

The Official "Gate" to the University

As alluded to earlier, Admissions can "admit" but an applicant does not become a student until "registration." In any case, during the initial registration for classes, the Registrar gives each student that official university recognition called the student ID card.

Degrees and Non-degrees

In addition to the great number of freshmen at universities, the Registrar is the focal point for the "admission" of all nondegree seeking students and for the readmission of former students. Because degree-seeking often spans decades, the requirement to maintain student records (transcripts) in some active and easily retrievable form necessitates maintenance of thousands upon thousands of records.

Registering Remotely

Registration at Florida State University occurs through the student's use of a touchtone telephone and a voice response unit on campus. Through this system, students are able to register for classes from the privacy of their home or, for that matter, from anywhere in the world. Using the touchtone pad, students can register for all of their courses in a matter of minutes.

Departmental Dynamics

Department chairs like the flexibility and immediacy of this on-line system. If a student comes to his "home" (major) academic department with a registration problem, a departmental staffer can make on-line intervention, such as overriding the section size to allow one additional student. Throughout the normal registration period, the academic chair can look at summary course data to determine if sections should be added or dropped. And, during the three-day "drop/add" period, the chair can change course attributes on the fly.

PROBLEMS COMMONLY ENCOUNTERED IN THE PROCESS

Another Paperless Office

The end of the admissions process is the beginning of the registration process. To put things in perspective, students are "accepted" for admission as early as the Fall of their senior year in high school and notification of acceptance continues on up into the Spring. The students' response to complete orientation is the trigger which moves their electronic file to the Office of the Registrar.

Getting a Full Schedule

The major complaint of students is that there are sometime not enough desirable courses available to give them a full-load schedule of classes. Some of this relates to personal preference on the part of the student.

The Registrar estimates that half of the present 20,000 drop/add transactions could be eliminated if the departments would take the simple step of listing an instructor name for each section.

APPLYING EMERGING TECHNOLOGIES TO REGISTRATION

A Multifunction ID Card

Gone are the days of the simple laminated, color photo, single-purpose university ID card. Most of today's university ID cards serve various purposes. Typically, they can also be used to check-out library books. But, Florida State University is pushing technology by making it a truly multifunction card for a whole host of campus activities. The "Seminole Access Card" is first a color photo embossed official university identification card with the photo a digitally impregnated color image of the student. The reverse side of the card has the conventional credit card magnetic strip and a narrower "vending" magnetic strip. Given all of these attributes, the card can be used as a university bank card (a private label card recognized by merchants as if it were a Visa or MasterCard and processed through a Florida bank's credit card center.) Financial aid funds are deposited directly into the student's Access account. Much like automatic payroll deposits, this system eliminates notifying students that checks are ready for pick-up, standing in line to get the checks, and depositing delays.

Voice Response Systems

Florida State's touchtone telephone registration system is alive and well.[4] But, one might say that such systems are in their infancy. There is a need for *off-the-shelf, user-friendly software* that provides the foundation for uses other than registration. As mentioned earlier, this same telephone response system has attributes that make its use a natural in financial aid and admissions.

Toward Universal Messaging

The next logical step is to take advantage of the trends in electronically delivered messages and integrate voice mail, electronic mail, and facsimile into a *seamless messaging environment*. Moving from the storage of text messages in voice mail boxes, we can now have them verbalized over the phone by a text-to-speech synthesizer. On the FAX side, today's popular voice-mail options is FAX store and forward, allowing FAX messages to be manipulated in the same manner as voice messages. Compared to separate systems, universal messaging lets users receive notification of all of their messages no matter how they access their mailboxes. Another advantage is that a message in one medium can be translated into another. Thus, after listening to a text message via text-to-speech synthesis, a user could send a copy to a colleague's FAX machine across the campus or across the country.[5]

The Electronic Registrar

The Registrar maintains an electronic file for each student. That often mentioned, *user-friendly software* needs to be developed to make all of the Registrar's functions into one integrated, computerized system.

The Directory of Classes Electronic Bulletin Board

There never seem to be enough *Directory of Classes* published to meet student demand. So, why not a *Directory of Classes Electronic Bulletin Board*? The same electronic file used to make up the tape for the printing of the *Directory* could be used in electronic form to allow students to read the *Electronic Directory* and take appropriate notes to complete the telephone registration worksheet.

Immediate Access to Old Data

Registrar's Offices are famous as "keepers of transcripts." Whether a current student or a golden oldie, the common belief is that the transcript is immediately available. Because of the volume of academic records maintained by a university, this application is ripe for a *hierarchical storage system* that minimizes the cost of computer files. Such a system needs to manage the process of receiving an inquiry, fetching, and sending responses with a minimum of human intervention.

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[4] Thomas James and Billy Norwood, "Touchtone Registration: Host Application Design Considerations," Proceedings of the 33rd Annual College and University Administrative Computer Users Conference (CUMREC), May 1-4, 1988, pp. 361-370.

[5] William W. Creitz, "In Good Voice," CIO, February 1991, pp. 70-73.

Certification Letters by Voice Response

The Registrar's Office receives dozens of calls and letters each day for "certification letters." A *voice response* application would allow the incoming call to take all the appropriate information. Then, using SQL, a clerk could retrieve the data in an on-line mode and in turn have the system generate letters responding to these requests.

Passing the Electronic Record

As mentioned earlier, the boundary between data stored as text, imaging, and facsimile is blurring. Once again, the human toil should be minimized by allowing the Registrar's staff to key in the name and address of the requesting university and let a smart set of software bring up the record and facsimile it from host to host or host to FAX or PC-FAX to host.

Electronic Grades, On Demand

Many faculty members maintain student grades on their PCs using "electronic grade books." Many facsimile machines transmit images in digital form directly into a receiving PC. Graphic and text scanners are present across the campus. Thus, the technology is present to make obsolete paper grade rosters by having the faculty members enter their course grades directly into the host computer.

The next step in student services would be to link the voice response unit with the grade system. Through such a coupling and assuming that the individual course grades start to be processed into the master grade file from the various electronic entry points, anxious students would be able to query the database to learn their grades on a daily basis.

CLOSING THOUGHTS

Now, how do we pull all of this off? Although we have been schooled to say, "plan for nothing less than a fully-integrated, total management information system," might it be timely to suggest a *piecemeal* approach? Today, with budgets so tight they squeak, we will have to find ways of identifying systems solutions that come in *chunks* rather than wholes. For example, we might have to be satisfied with installing an imaging system as a pilot project in admissions rather than hold out for a million dollar, campus-wide system.

But remember, significant improvement in information systems requires top-management support. We will probably need to "sell" the respective vice presidents on the importance of an integrated technology approach for the various functional operations. Yet, the VPs should carry the day with the President so that there is an institutional commitment for change.

Begin with an architecture, a strategic plan for administrative information systems. Sell the "principals" on step-by-step improvements. Demonstrate credibility with small success stories. Adopt lofty goals, such as:

-- A totally electronic entry system -- *stomp out paper*!
-- Place servers in departments for distributed systems -- *empower users*!

-- Install smart/expert systems -- *let computers do computing* and
-- *allow people to be personal!*

A few closing words for the wise:

-- New *productivity* applications may not increase productivity.
-- Simple application *tools* may not be simple.
-- *Technologies* which promise less work, may not.
-- Although things will improve, nothing happens overnight![6]

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[6] Cynthia Golden & Dorit Eisenberger, "The Effect of Relational Database Technology on Administrative Computing at Carnegie-Mellon University," CAUSE/EFFECT, Winter 1990, pp. 23-29, 34, 53.

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Decision Support Database Operations at Boston College

John Spang
Boston College

DECISION SUPPORT DATABASE OPERATIONS AT BOSTON COLLEGE

John Spang
Database Administrator
Boston College

1. Introduction

1-A. Background

Administrative computing at Boston College is performed primarily in an IBM environment. The system is based on an IBM 3090 with most application programming done in the CICS environment. IBM's indexed sequential file structure "VSAM" is the primary storage method for administrative data. Batch work is performed after hours, for the most part, utilizing a mix of maintenance programs - mostly in PL/1 - and reports - mostly in Easytrieve Plus. User access to the data is available via CICS transactions, as well as the ability to define selection criteria for many overnight reports.

While clerical functions are still performed on terminals "hard-wired" to the IBM mainframe, most professional staff have a microcomputer available to them, with "dial-in" connectivity to either the IBM mainframe or the university's DEC/VAX cluster. Apple Macintosh computers, in all flavors, outnumber IBM PC's and PS/2's about four to one.

The standard reporting media are paper and microfiche, although there is also an "ad-hoc" ability to provide data on a diskette so that a department may copy the diskette into some PC-based application. While an existing report may be run overnight, a request for a new report may take weeks to provide, depending on the usual M.I.S. backlog considerations. Thus many departments do a considerable amount of "re-keying" of report data into PC-based applications, most notably spreadsheets, in order to manipulate the data locally and be able to provide fast ad-hoc reporting when needed.

In addition to using microcomputers to hold copies of mainframe data, most departments also run departmental systems to track data elements that are beyond the scope of the host-based applications. While satisfying local requirements, these applications vary considerably depending on the preferences and capabilities of the personnel in the department. Needless to say, from a database administration position, such departmental systems are a liability, with no solid mechanism for data management, but a penchant for using outdated information. From a support standpoint as well, these systems are liabilities because there are no university-wide standards regarding data elements, PC tools, etc. Thus the support areas must maintain the capability to support numerous similar products.

1-B. Needs Analysis

In responding to the problems posed in the above scenario, M.I.S. management developed a plan to provide what we called "redundant database services" to the administrative and academic offices. The goals of the project were to provide:

a. fast, customized read-only access to the user's host data for decision support

b. a formal means to download data to microcomputers

c. a common platform for departmental systems, including referential integrity to host systems

Item "c" above was considered the "second phase" of the project. It was included in response to our concern that departments might be using their local systems INSTEAD of the more formal host-based systems, in order to gain better flexibility and access to the data. While perhaps productive for that office, such a process obviously wreaks havoc on host systems on which multiple departments require access to the same data, thus actually hampering productivity on a larger scale.

1-C. DBMS Selection Process

A project team was selected to evaluate a number of database solutions. The "givens" were that the project would reside on Boston College's VAX cluster (running VMS), and that the solution would be SQL based. The VAX was chosen because it was already the end-user platform of choice at the university. Many additional statistical tools were available, as well as more versatile PC file transfer capabilities. The team evaluated a number of products using "RFI's" and a smaller number of "RFP's" to narrow the field to acceptable candidates. The result was a recommendation that INGRES be chosen as the database. A site license was negotiated and signed in June of 1990, with installation in August.

Part of the recommendation was that, while INGRES was selected for the quality and flexibility of its database, as well as licensing options, there was a shortcoming in "ad-hoc query" and report-writing tools. To alleviate this problem, we began to address "front-end" products that would provide a user-friendly environment for staff who were using INGRES for reporting purposes. This process led to the selection of SQLASSIST, a product of Software Interfaces in Houston, as the standard user interface to INGRES.

As an aside, it should be noted that the selection committee was also very interested in providing database services to the academic user community; both for research and instructional purposes. INGRES is also available to, and increasingly used for both of these purposes, but that is beyond the scope of this paper.

2. Decision Support Database Logic

2-A. Design Decisions

The process of granting "end-user" access to "production data" is much more complicated than simply giving them a reportwriting tool and security access to host files. The host files at Boston College generally reside in IBM "VSAM" file structures. These files are designed to optimize performance in CICS, IBM's teleprocessing monitor, not to optimize end-user reporting. The multiple record types, arrays, flags, etc. that are part of an efficient system in this environment make these files overly complicated for most end-user computing, drastically increasing the possibility of "wrong results" from a report.

In addition, the sizes of the files were prohibitively large. The resources available to the project were not sufficient to copy the entire production database over to the VAX for end-user access. Finally, the limited indexing in the transaction-oriented VSAM database would not efficiently manage ad-hoc queries, thus allowing queries to interfere with transaction processing.

To address these two issues, we decided to create a new set of structures that would "paraphrase" each of our systems. We used the "80/20 rule" (i.e. 80% of the data requests could be completed with 20% of the data) to create much simpler versions of the production files. We also excluded records from files that were not required for our purposes (e.g. student records of non-active students). Thus our decision support student record used about 50 of the over 300 elements on the file, and reduced the record count from over 55,000 records to the approximately 15,000 active students. A little simple math suggests that we are using about 5% of the space required for the production student file. While we did not always generate such a high degree of space saving, typically the database application used less than 20% of the space required for the production equivalent.

Naming standards were also altered to simplify the report generation. Most importantly, fields which were natural "joins" in SQL'ese were similarly named. This aided the user (and the front end) in identifying the join logic required to produce reports from multiple database tables. SQLASSIST automatically joins on like-named fields, an option which can become a two-edged sword if not managed properly. (See comment in "Lessons Learned" below).

Next, the data was normalized to a greater extent than in the production systems. Because users cannot update the fields in the redundant database, we can tune the system for flexible, ad-hoc retrieval, using performance options and additional indices that would not be feasible in a transaction environment. This luxury allowed us to eliminate some of the de-normalization required to guarantee efficiency in the production systems. Indexing and other performance options were tuned to allow fast retrieval of bulk data, as required for ad-hoc queries.

Lastly, we designed views to insulate the users from the normalization. This allowed us the best of both worlds in that users with simple requests could use the simple views, making their data appear as if it were a single table. Users with complex requests had access to the normalized base tables and could perform complicated SQL queries against these "properly normalized" tables. For example, our human resources database contains six tables that allow complicated queries against salary information, secondary positions, etc. *But there are also views called* "EMPLOYEE" and "FACULTY" which simply list basic information about these people and their jobs, taking data from four of the tables.

2-B. Comments on Database Design Logic

Several specific issues arose during the creation of the database standards. These are discussed here with our resolutions and the logic behind them.

An early decision was made to utilize many "codes" that were imbedded in the database "as-is" rather than always expanding them to the related text value. For example college code "01" refers to the "College of Arts & Sciences" Student records contain the two-digit number, which can be used to look up the expanded text in another table. Views can also be used to make it appear that the text is stored in the student record. There were several reasons contributing to this decision:

a. Many users were very familiar with the codes

b. Some of the related text was long and oft-repeated, making it difficult to use in a query

c. A "lookup" table was easy to create and had some informational merit of its own

d. Since some of the expanded text was truly untenable as a search value, it was better to have one consistent standard than to use different tacks in different situations.

A second decision was to store like data in a single table and use views to discriminate blocks of records, rather than create separate tables. For example, all student records for all colleges in the university are located in a single table. Each college accesses the table using a view which allows access only to students within that college. This style is easier to maintain for the DBA and also allows global searches without using multiple "UNION" clauses.

There is a tendency among some users to use the database to replace "production" reports. This was generally discouraged, although some ad-hoc queries have become the basis for production reports. It is a mistake to place the clerical burden for production-like information needs on the shoulders of the manager.

Any query that was consistent in design, and run on a predictable schedule could be submitted to the Management Information Systems Department for consideration as a production report. The exception to this rule was users who needed the report in electronic format for use in other applications (e.g. spreadsheets).

3. Implementation Process

3-A. Data Extraction

Implementing a specific system (e.g. admissions, human resources) required a number of distinct steps. As we used our student system as the "pilot project", with various deans' offices as the end users, we will also use that as the subject to demonstrate the process.

The first step was to design the database. We met with the users in a series of meetings to determine just what data they would need to satisfy the bulk of the requests which were not being met by the production systems. The tools of these meetings were current reports and record layouts of the existing production files. Once users were aware of what was available, they could generate a "wish list" of the types of data requests they envisioned making against the decision support database. These elements were selected and placed in a normalized file structure. The end result of this process was a series of record layouts, which correspond to the decision support database tables.

The second and often most technically challenging step, was to create a program that would run against the production database and create "extract files" which corresponded to the table definitions generated above. Because these programs were basically generalized reports, we used Easytrieve Plus (the standard M.I.S. production reportwriter) to read the host files and generate the extracts. The non-normalized nature of the production data, especially in purchased packages it seemed, made some of these programs much more difficult than simply reading files and selecting fields and records. The result of this process was a series of sequential files, that corresponded to the database tables as effective "unloaded copies" of the database.

The penultimate IBM-resident step in the process was to copy the files to an ASCII-labelled tape, so that they could be made available to the VAX system. This seemingly low-tech solution to this problem deserves some explanation. While we had some rudimentary file transfer mechanisms available between the IBM and VAX systems, these were not up to the task of providing production level services. The file transfer mechanisms did not have a "virtual disk" capability, where an IBM file could be read by the VAX as if it were a VMS file, nor was there a direct disk to disk transfer method. The transfer mechanisms required that the files be explicitly received, which would be additional tasking for some production control person, as well as a chance for error. In addition to avoiding problems, the tape acts as a backup to the system, since the data will be "read-only" once loaded.

The last step in the IBM job stream sent a message to the VAX computer on which the DBMS resides. The VAX systems group set up a procedure that would interpret this message and initiate a job that would use the tape to load the database. The message included a security string, the tape volume serial number, and the name of the process which was to be initiated to load a specific database.

This procedure to create the extract files was scheduled to run overnight. It could be initiated after all of the student processing was complete, ensuring an accurate snapshot of the student system as it existed at the "close-of-business".

3-B. Database Loading

The message received from the IBM job was interpreted by the VAX and a "COM" file was submitted with the tape volume and database name overrides. This COM file caused the following processes to be executed:

a. The tape was mounted

b. The data was copied to temporary workspace, converting it to a variable length VAX file. This step freed up the tape drive quickly, allowing other jobs to use it. (VAX tape drives are a very scarce commodity).

c. The database was dropped and redefined.

d. The INGRES "COPY" utility was used to load the tables from the temporary datasets

e. The tables were "MODIFIED" and indexed to the most appropriate format.

f. All required views were created

g. All grants were applied to the new tables to provide access to end-users.

h. The new tables were "optimized", meaning that INGRES generated statistics that aid in query optimization.

This sequence of events took from 15 minutes to 90 minutes, depending on the size of the data and the number of concurrently running load processes. However, the time frame was generally around 3:00 A.M. so there was minimal inconvenience.

Any errors in the data were written to an "error-log" file. If the problem could be corrected, the error log could be edited and re-applied to the database. If not, the error log served as a diagnostic tool to help "fix" the extraction program. The most common error was incorrect data in fields in the IBM production database (e.g. an improper date). As an aside, these error logs have helped us to improve the editing of our data collection mechanisms in the production database.

Deleting and redefining the database was a far faster process than attempting to update in place. Journaling was turned off for all updates, since recovery called for simply rerunning the load process. If any VAX hardware problem occurred at any time after the load, the same COM file could be used to reestablish the database.

All views and security access "grants" are stored in command files in the DBA's VAX account. While INGRES allows for online creation and update of such aspects, we believe that such undocumented changes get "lost in the shuffle", particularly during error recovery. In fact the only times we have had to recover under duress, we simply re-sent the command from the IBM system and the load process was re-initiated. There was no need for special recovery procedures.

3-C. User Procedures

The target users for this project ranged from experienced VAX users to managers who had never used the VAX. Rather than duplicate effort, we used existing training procedures for VAX systems to bring all users up to at least an introductory familiarity with VMS. While using the database itself does not actually require any VMS knowledge, saving files, customizing, file transfer, etc. are greatly enhanced by training the users in those functions.

VAX accounts for all users typically needed to be modified to allow greater resource limits (INGRES documentation is very specific on this point). In addition, several entries are required in the user's "LOGIN.COM" file. These define the terminal type to INGRES, as well as allow some customization. We have set default "logicals" that apply to most users, but it is often necessary to override these for users with specific needs.

The user enters the reporting environment by initiating the "SQLASSIST" program from the VMS "$" prompt. (Users with no other functionality on the VAX are often "auto-logged" onto SQLASSIST). The initial menu is laid out in a "LOTUS-123" style with major options across the top, and "pull-down" menus for the currently highlighted major option. The user can select from:

a. generating a query

b. formatting or running reports

c. saving or retrieving queries

d. modifying options

e. typing a query without assistance or prompting

Typically, users will elect to generate a query. They are constantly presented with the next logical option. For example by opting to generate the SQL "SELECT" clause, the user is presented with a list of all the tables and views to which he has access. Selecting a table causes the list of elements within that table to be listed. Selecting an element includes it in the report. These functions are all basic SQLASSIST functions, with minimal programming and customizing.

Experience with the database generally results in two phenomena:

a. Users develop model queries that serve as the basis for the majority of their work

b. Users request additional views, based on the manner in which they tend to use the tables

The second of these can be dangerous. By offering the user many very similar versions of the same data, there is a strong chance for confusion as to which view should be used in a query. Our rule of thumb is to use one view per user for each major grouping of tables. In other words, we will use views to simplify join logic, much more readily than to select certain records from a given table.

For a number of users, the decision support database is simply a means to get production data into their micro-based decision support tool of choice: the spreadsheet. SQLASSIST has a very useful mechanism that converts the formated results of a query into a new file that is either in LOTUS format, or delimited format (The delimiting character can be specified so this works for both Macintoshes and PC's). The original results file is not effected. A typical process would involve:

a. running the query to a file

b. converting the results to a delimited format, optionally keeping column headers

c. using their terminal emulation package to download the delimited file to their Apple Macintosh

d. opening the file in EXCEL as a spreadsheet

Once users complete step "b", they are no longer in the database system. The files are now simply VAX files that can be treated like any other VAX files. They can be edited, mailed, etc. as the user sees fit.

3-D. Departmental Systems

While still in pilot project status, we have developed several "departmental systems" for which the decision support database acts as a redundant repository of "host-based" information. A typical model is the graduate chemistry department which tracks a number of variables about graduate chemistry students which are required for their degree. These fields are not available on the production system, and historically had been kept manually, or in various PC file management applications. A small application is built which maintains records that link back to the redundant student database for much information. The user receives the benefit of the referential integrity (e.g. records cannot be added for a student whose ID is not in the system). Also, all of the demographic and academic data is available in reports which combine data from the redundant database tables and the departmental application tables. Data is also backed up without any effort by the department (no diskettes). These advantages form a dramatic step forward from the independent file maintenance procedures that it replaced.

3-E. Future Plans

The logical work flow for many of the users is to extract data from the database, convert and download the results to their microcomputer, and then manipulate the data using micro-based applications and printing. In order to facilitate this, we are attempting to minimize the manual processes involved. Using products such as "DAL" to lend an intelligent link between Macintosh's and INGRES, We intend to allow users to sign on to a micro application and open a window that allows them to generate or recall a report request. This request will be run, results downloaded and converted into the format required and the data opened on a spreadsheet, etc. This will allow the users to concentrate their training and efforts on the decision support tools themselves, not on the process of providing them with data.

4. Lessons Learned

4-A. Design

When designing the layout of tables for a specific database we found it preferable to look at the table as a simple report, rather than as raw data. The philosophy of the decision support database is granting the user informational access to his data, not granting him the means to write applications against it. We want to give him the same information we have been giving him, only do it in a much more flexible, useful and customized manner. Users are familiar with reports, and tables that appear as reports are intrinsically more useful to them.

One issue that continues to cause problems is the ability to give "online help" concerning a specific field's meaning or possible values. This is exacerbated by INGRES's lack of a "comment" field for elements in the system catalog. Users often must search for the correct value of a where clause (e.g. is it "T" or "F", "Y" or "N"...). A partial solution was to indicate as part of the element name that it was a "code" and provide "lookup tables" which list the codes and their expanded text. This works for some fields, but requires the user to look these up in advance. We would like to develop a "pop up" style window with information about each field that the user could invoke while generating a query.

Our implementation provides a "snapshot" of the system at the time the extract was produced. While this works for ad-hoc and exception reporting, the lack of "time series" data available often limits more "executive" requests, such as trend analysis. While users could store the data periodically themselves and use additional tools to provide this level of analysis, it is a burden that few select. We are currently evaluating several systems in which we provide multiple copies of the same tables, over time. The SQL language unfortunately does not lend itself to accessing such duplicate table structures, and often very-involved views are needed to provide information in an understandable format.

The naming conventions of logical "join fields" require close attention. Like many similar products, SQLASSIST provides an ability to automatically join tables on like named fields. Generally this is very useful, and it allows us to join, for instance, a student to his course records based on the common "student_id" fields, and the course records are tied to the course description table by "course_id". It can become dangerous if there are other fields which have similar names but should not be in the join. Given the above example, if both the student and course description tables had a "college code", the former indicating what college the student belonged to and the latter indicating the college that sponsored the course, an "autojoin" would be performed on these fields and all courses taken by students outside of their college would be lost. It is critical to eliminate such inconsistencies, as a few "bad" reports will seriously weaken the users' confidence in the system.

4-B. Support

A large number of the managers who could take advantage of the database are in departments whose primary functions are "online" in the IBM transaction environment. As such, their networking access is minimal, often restricted to "coax connections" directly to the IBM mainframe. Introducing functionality on the VAX for these users was not a "good fit" with their communications capabilities, and the conversion of communications capabilities has very often become the "critical path" in providing these services. The lesson is to address these logistic issues in advance of the design phase, as you may end up waiting for them with a completed application.

We were initially surprised by the speed with which some users developed the ability to generate rather complicated queries, or more properly, queries with complicated where clauses. We had arranged our training to move gradually from basic one-table queries, through "joins", then aggregates, etc. We found that some users would move rapidly through these functions within a few weeks. The desire to find exception conditions, rather than to duplicate "stock" reports added to the tendency to use complicated selection logic.

There is a tendency among some users to look at the INGRES reporting database as an alternative to production reporting. We generally restrict the variables available so that it is intentionally difficult to simulate production procedures. For example, Boston College has a production process for generating addresses for given lists of students. The INGRES database does not include full addressing information, to avoid having users circumvent the accepted mailing practices.

Several of the most useful SQL operators are the "EXISTS" and the "HAVING" clause of the "GROUP BY" operator. Users seemed very reluctant to use these. "UNION" suffers from the same phobia, although to a lessor extent. Trainers might want to place special emphasis on using these facets of the language.

It is important that users "trust" the information they retrieve from the database. The training process must ensure that they know exactly what the extraction process selected, and how database fields map to their respective production fields. It is a good idea to review the query logic of the first several report requests of new users to ensure that they are getting what they think they are getting. Our logic is that "We would rather give you nothing than something wrong".

4-C. Operations

Many production systems have cyclic "purges" when they are initialized for the next year, etc. The decision support database was particularly useful immediately after such purges, as they gave managers a decision support tool, while the production data was being initialized. In such cases, we would halt the scheduled refresh of the data for that system, until the user indicated that the system should be refreshed with current data. For example, the admissions files are "purged" in October of records pertaining to the then-Freshman class. What is left in the production file is a statistically insignificant number of very early admissions. What the department would much prefer to do is run statistical studies on the "purged" data, matching their attendance and performance against what they had predicted and perfecting their models.

All database refresh procedures are listed as production procedures with the M.I.S. Production Control staff. They are typically scheduled to run weekly on the most appropriate night (e.g. many student system procedures run on Monday night, so

Tuesday we refresh the student database). It is very easy to run the procedures on additional nights, as no special interventions are required.

Users accustomed to transaction systems often initially treat the redundant database's reporting mechanism as another transaction. They may develop a query joining multiple tables with thousands of records each and sorting the result, then wonder why the terminal does not return the answer quickly. We have tried to stress that we are offering information in "minutes rather than days", but not in seconds. Users are encouraged to use the "batch submission" option in SQLASSIST for all but the briefest queries.

The logic behind decision support systems does not always make the ideal basis for a departmental transaction system. Transaction systems often require more data to provide adequate validity of maintaining data. For example, if a student drops out, the decision support system can simply exclude that record from the table. But the departmental system might have other records pertaining to that student. What is their status? These issues need to be addressed in designing the departmental system and may lead to compromises in database design.

5. Conclusion

We believe that the redundant database project has made a large advance in providing "information from data" to our user community. We have replaced both the manual rekeying of much data into decision support tools, as well as provided managers information for decisions that the more classical M.I.S. procedures simply could not have serviced in time.

There are a number of areas where we have a long way to go. To truly link the PC-based decision support tools to our information sources, we must eliminate many of the manual steps involved.

Lastly, while these services have been appended to the options that a user has to gain access to information, they will be much more effective in future applications where we can incude these capabilities in the design of the production systems.

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Developing a Computerized Multi-Campus Transfer Information System

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DEVELOPING A COMPUTERIZED MULTI-CAMPUS TRANSFER INFORMATION SYSTEM

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INTRODUCTION

An increasing number of colleges and universities throughout the country are recognizing the importance of transfer students and the need to improve the transfer process. In December 1986, the University of Wisconsin System Board of Regents published a report entitled "Planning the Future: Report on the Future of The University of Wisconsin System." Several resolutions in the report focused on improving transfer into and between UW System institutions. One resolution called for the establishment of a computerized credit transfer system that would become the official course equivalency and degree requirement table for the UW System. The Wisconsin State Legislature approved funding for this project with the stipulation that the Wisconsin Vocational, Technical and Adult Education System be incorporated into the system. This paper describes what the system is, how it works and the process that was used to develop, design and implement it.

BACKGROUND

The University of Wisconsin System (UW System) is a public multi-campus educational enterprise consisting of thirteen 4-year institutions, thirteen 2-year centers and a statewide extension program with a systemwide enrollment of more than 155,000 students. Each 4-year institution has its own course catalog and numbering scheme. The 2-year centers use a common catalog with common course numbers. Last year over 12,500 students transferred into or between institutions within the system. The 2-year centers had the highest percentage of outgoing transfer activity among the institutions. However, there was also considerable transfer activity between the 4-year institutions. In fact, there was more outgoing transfer activity between the 4-year institutions than from the 2-year centers into the 4-year institutions.

The Vocational, Technical and Adult Education System (VTAE System) is a public multi-campus enterprise consisting of 16 technical colleges enrolling more than 102,000 students in associate degree and vocational diploma programs. The main mission of the VTAE System is to prepare people for the workplace. Three of these institutions have statutory authority to offer college parallel courses in addition to their technical curriculum. Last year just under 1,400 VTAE students transferred into the UW System, primarily from the college parallel programs.

FUNDING

The transfer information project included funding for three full-time professional staff at the UW System central office. The positions consisted of (1) a project administrator primarily responsible for project development and planning, transfer policy coordination and budgetary supervision, (2) a project coordinator primarily responsible for coordinating and maintaining the data and for developing and conducting training programs, and (3) a technical coordinator primarily responsible for developing the system design and program software and for coordinating the hardware purchases and installation. Additional part-time programming staff has also been used.

Funding also included provision for computer hardware and software. These funds have been used essentially to provide UW System institutions with workstations to access TIS and to maintain the system. Funding did not include provision for increased staff support at the institutions.

CURRENT TRANSFER POLICY

In December 1989, the Board of Regents approved a revision of the UW System Undergraduate Transfer Policy in an effort to improve the transfer process within the UW System. The new policy called for a "spirit of accommodation" for transfer students such that maximum recognition would be given to courses satisfactorily completed in applying toward requirements at the receiving institution. Transfer students were to be treated similarly to non-transfer students in determining degree requirements, registration priority and admission to majors and programs.

In addition, the new transfer policy required that transfer information be made readily available to students and that UW System institutions publicize changes in admission and degree requirements well before implementation. The computerized transfer system was envisioned as a key resource for communicating transfer information and changes in admission and degree requirements to students and staff.

Credit transfer policies between the UW and VTAE Systems have also changed significantly in the past few years. The most recent agreement permits transfer of up to fifteen credits of VTAE non-college parallel general education courses into UW System institutions. The policy also encourages the development of program-to-program articulation agreements that may include transfer of additional non-college parallel courses. As a result of these changes, the number of VTAE transfers is expected to increase over the next few years.

PROJECT DESCRIPTION

The Transfer Information System (TIS) provides students and staff with accurate, current and accessible information to assist students with decisions that will enable them to transfer into and between UW System institutions and complete their degree programs without unnecessary delay. It is a comprehensive means of organizing defined information that can be used to improve the transfer process.

The project has been divided into phases and will be implemented progressively beginning with pilot sites and gradually expanding to the other institutions in the UW and VTAE Systems. It is conceivable that state high schools may eventually obtain access and that other colleges and universities may be included in the system.

The four project phases are as follows:

Phase 1: Courses and Transfer Equivalencies

A: A course equivalency matrix matching UW-Center and VTAE college parallel courses with the equivalent courses at UW System institutions.

B: An expansion of the course equivalency matrix to include the matching of lower level (freshman/sophomore) courses at all UW System institutions and other transferable courses at the VTAE System institutions.

C: An enhancement of the equivalency matrix to include descriptions, credits, prerequisites, breadth and level designations for all courses as well as equivalencies for selected upper level courses.

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Phase 2: Institutional Information

A: A reference menu containing information about all UW and VTAE System institutions including institutional descriptions, admission requirements, transfer procedures, financial aid and campus housing.

B: A catalog of majors, minors, preprofessional/professional and degree programs at each UW System institution and associate degree programs at VTAE System institutions.

Phase 3: Academic Program Requirements

A: A comprehensive listing of general education, major, minor, preprofessional/professional and other degree requirements at each UW System institution and requirements from selected associate degree programs at the VTAE System institutions.

B: A summary of recommended courses that will best prepare a student for transfer into selected academic programs at a given UW System institution.

Phase 4: Transfer Progress Reviews

A: A personalized evaluation indicating how an individual student's academic record and/or proposed list of courses applies toward completion of any degree program at any UW System institution.

TECHNICAL BACKGROUND

The computing center for the UW System central office provides a wide range of services that include applications for areas such as facilities, risk management, payroll and staff benefits, accounting, student financial aids, and curricular and student data. The center is supported by an IBM 4381 running DOS/VSE under VM. Systems are predominantly written in COBOL and Natural in an ADABAS data base environment.

Each 4-year institution in the UW System has its own computing center with applications including individual student record systems. The technical environment at the institutions varies greatly with mainframes, minicomputers and local area networks from vendors such as IBM, UNISYS, DEC and others. Similarly, the VTAE System institutions have diverse technical environments and applications. The 2-year centers have local area networks that are linked by a wide area network called CentersNet.

In 1990, the National Science Foundation (NSF) awarded a grant to a consortium of UW System institutions and Wisconsin private colleges to develop WiscNet, a statewide telecommunications network to be used primarily for academic applications. It is anticipated that the network will be expanded to include VTAE System institutions.

TECHNICAL DESIGN

When development of TIS began in 1988, no systemwide or statewide data network existed that could provide inexpensive communications between and among the UW and VTAE System institutions. Without such a network to link the institutions, it was decided that the first phase of TIS would be developed as a micro-based system on stand-alone microcomputers or on microcomputers linked in a local area network. This design provided a consistent hardware configuration for the institutions, which could be installed in a relatively short time. It also permitted the use of software that was ideal for developing user-friendly prototypes. Data was gathered centrally and distributed for storage and processing on the microcomputers.

With the arrival of WiscNet, new design options for TIS that made better use of existing hardware, networks and other campus resources became possible. A technical working group was formed in 1990 to suggest new design alternatives for TIS. Among its recommendations, the working group suggested that all data and processing for the first three project phases be centralized at a central computing center with WiscNet used to access and maintain the information. In the future, institutions could be provided with the option to decentralize portions or phases of TIS, storing and/or processing the data at their campus computing centers. Because most institutions have or will have their own degree audit systems, the working group further recommended that the final project phase (Transfer Progress Reviews), be totally decentralized with access provided to transfer students through TIS.

As a result of the working group recommendations and technological advances such as WiscNet, a conversion of the current system from a microcomputer to a mainframe system is being investigated. The TIS project staff is currently developing an automated maintenance process on the mainframe for course and transfer equivalency data. If the mainframe system works well for maintenance, conversion of the current system will follow.

HARDWARE AND SOFTWARE

The microcomputer version of TIS was developed using Paradox, a relational data base, which runs on IBM compatible microcomputers under DOS. It can operate on stand-alone microcomputers or in a local area network (LAN) environment. It has been successfully installed in both Novell and Starlan networks. The minimum configuration recommended to operate TIS includes:

- IBM compatible PC
  - 386SX 16 Mz Processor
  - DOS 3.2
  - 2 Mb RAM
  - 30 Mb Hard Disk
  - Paradox 3.0 or Paradox Runtime modules

The TIS software program is menu-driven requiring minimal user keying that includes a highlighting selection procedure. It is written for either a color or monochrome monitor. It is designed so that first time users can operate the system with little, if any, outside assistance. Users can view requested information on the screen and can print the information on a local printer.

DATA COLLECTION AND MAINTENANCE

Course data required for TIS Phase I (Courses and Transfer Equivalencies) is currently collected on a magnetic tape submission three times each year. The central course data base is updated from these submissions and reports are sent to each institution indicating the number and nature of the updates. The institutions reevaluate their course equivalencies based upon these updates and send any updated equivalencies to the central office. This submission is currently being done on paper reports, but will soon be replaced by an automated batch process. An automated on-line process is also being developed to permit urgent updates to both the course and transfer equivalency data bases. Data collection and maintenance for the other project phases will use this automated process, but the timelines will vary based upon the nature of the information.

PROJECT DEVELOPMENT, IMPLEMENTATION AND EVALUATION

I. Advisory Groups

From the outset, it was determined that the design, development and implementation of TIS would be a collaborative process involving all UW System institutions and the VTAE. To accomplish this, three advisory groups were established.

The TIS Advisory Committee was created to help the project staff define procedures and guidelines for the project and to recommend solutions to issues that dealt with system or campus policy as they related to TIS. The group is composed of staff, faculty and students with one representative from each UW System institution and a representative from the VTAE System. For the first two years of the project, the group met about five times a year. Now, the group meets twice a year with additional teleconference meetings as needed.

Another group was established to help define how TIS would be implemented in the VTAE System and how VTAE data would be represented, collected and maintained. This group is composed of VTAE representatives from those areas that are or will be involved with TIS (e.g., admissions, student records, academic affairs, computer centers). This group meets with the same frequency as the TIS Advisory Committee.

Each UW System institution was also asked to designate an individual to serve as a liaison to the project to coordinate its implementation at the institution. The TIS Liaisons are called upon as needed to develop or review recommendations on such matters as training procedures, equipment installation, data gathering and maintenance.

II. Design Strategies

As indicated earlier, the project is being implemented in phases. The design process used by the TIS project staff is essentially structured analysis. The staff begins the process by developing a model for the phase including sample screens created in a word processing format and data flow diagrams. The data flow diagrams are developed to identify and define appropriate relationships between required data, data sources and data delivery. This model is shared and refined with pilot institutions selected for the particular phase. Terms used in the model are defined and debated in an effort to develop commonality and consistency among the institutions. The model is then shared with the TIS advisory groups to insure that all institutions are comfortable with the general direction of the project phase.

This model becomes the initial design used by the programmer to develop computer prototypes. The prototypes are shared and refined with the pilot institutions in preparation for the pilot study.

III. Pilot Studies

Three or four institutions within the UW and VTAE Systems are selected as pilot sites for each project phase. Besides assisting with the development of the model, the pilot sites conduct a test of the prototype system at their institution. Approximately 100 students and 25 staff at each pilot institution are asked to use the system and complete evaluation forms. These evaluations form the basis of the final report written by each pilot institution to determine what modifications, if any, are necessary in the prototype system. Once final modifications are made, the system is reviewed by all of the institutions for final approval before implementation.

IV. Implementation

In order to implement and maintain TIS, each institution is asked to establish a campus coordination team. This team, headed by the TIS Liaison, administers the project and provides necessary project support. The responsibilities of the team include the following:

- collection and submission of TIS evaluation reports
- coordination of campus staff training
- coordination of data gathering, formatting and maintenance
- development of a campus TIS implementation plan
- establishment of communication linkages to support TIS
- verification of TIS institutional data
- integration of TIS into institutional computing systems
- maintenance of TIS hardware and software
- trouble shooting of TIS hardware and software problems

Typically, coordination team members are drawn from those areas that have the most involvement with TIS. These areas include admissions, student records, academic advising and computer center. Some campuses have included members of the faculty or academic administration on the team to address any issues that may affect institutional policy. The TIS project staff works with the coordination team in implementing the system at each campus. The staff conducts training sessions, assists with hardware and software installation and provides ongoing support.

V. Evaluation

User evaluation of TIS has been built into the system. At the end of each session, the system asks users to answer a few questions about their experience with TIS. The questions attempt to determine whether the user found TIS easy to use and operate, and if the information they obtained was helpful. Also built into the system is a means to count the number and type of users (student, faculty/staff) by institution and the functions that they use. This information will be used to determine future directions for TIS.

CURRENT STATUS

The initial phase of TIS is currently operational in the 2-year centers. It is anticipated that the remaining UW System institutions will be operational in Fall 1992. Meanwhile, additional data will be collected to enhance the transfer equivalency data base and to support the remaining TIS project phases.

The pilot institutions for the second project phase (Institutional Information) have been selected. A model for this phase is nearing completion and a pilot study is planned for Fall 1992 with implementation scheduled for the following spring. It is anticipated that the project, as a whole, will be completed in 1995.

BENEFITS

Transfer students and transfer advising staff should realize significant benefits from TIS. Accurate and accessible information will assist students with course and transfer decisions enabling them to transfer into and between UWS institutions and complete their degree programs without unnecessary delay. TIS will also provide staff with an efficient and effective system to communicate course, major, degree and other program changes within all UW and VTAE System institutions.

APPENDIX I

The following is a list and description of the TIS screens and reports found in Appendix I.

SCREEN I - WELCOME SCREEN

This is the initial screen for the Transfer Information System.

SCREEN II - MAIN MENU

This screen lists and describes the various options that will be available in the Transfer Information System. It also illustrates the cursor sensitive TIS "Help" function.

SCREEN III - COURSE LIST

This screen provides the user with a list of the selected courses that will be used for accessing course equivalencies.

SCREEN IV - COURSE EQUIVALENCIES

This screen provides the user with equivalency data based upon input of several parameters including from institution, to institution, courses taken or to be taken, and year/term taken.

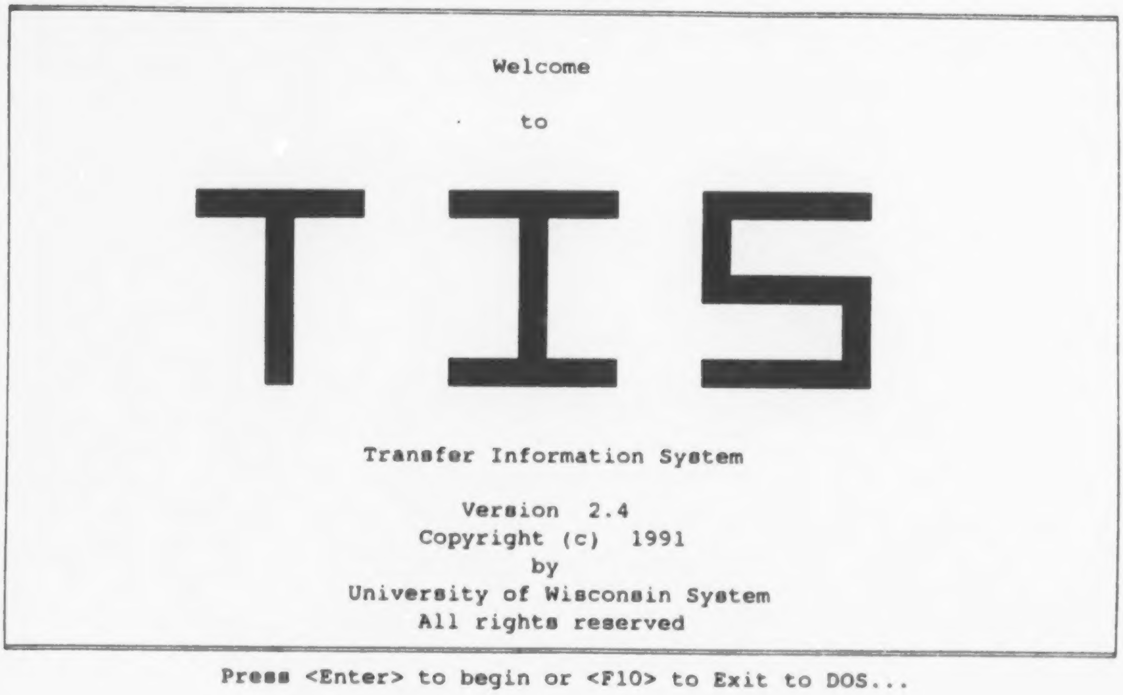
SCREEN V - SPECIFIC COURSE EQUIVALENCY INFORMATION

This screen provides the user with more detailed information about the course equivalencies including credits and course level granted by the to institution, general education requirements met and special circumstances related to the specific course equivalency.

SCREEN VI - COURSE EQUIVALENCY REPORT

This report is a summary of the course equivalency detail seen on the previous screen. The user is encouraged to print this report upon completion of each TIS course equivalency query.

SCREEN I



```
                Welcome

                   to

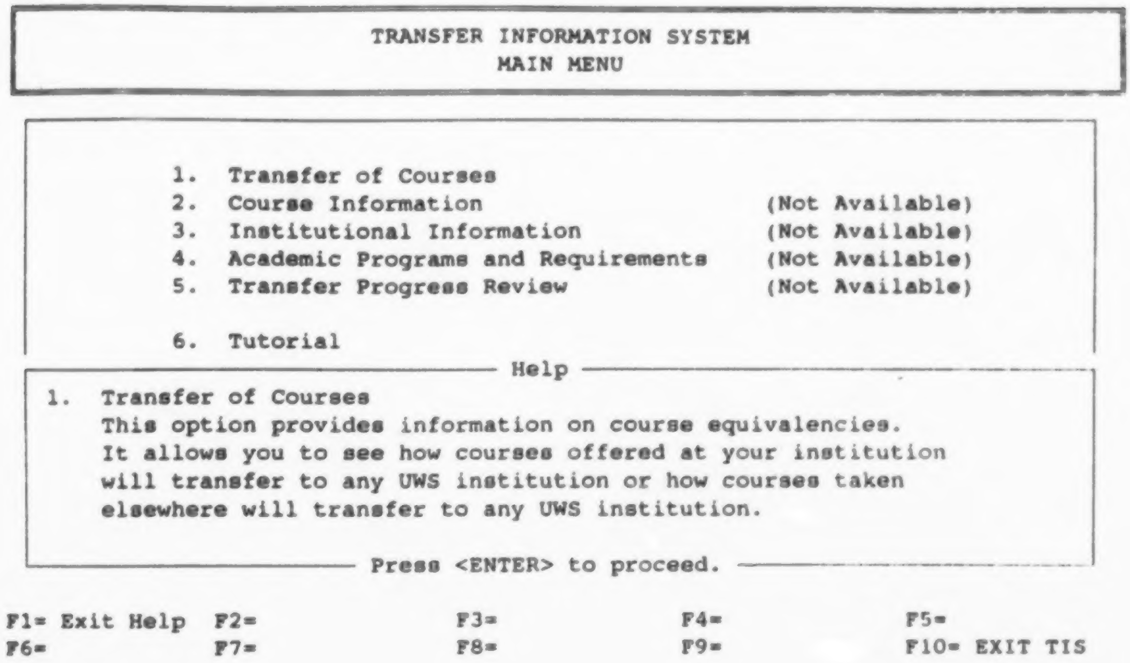
               T  I  S

       Transfer Information System

              Version  2.4
           Copyright (c)  1991
                   by
      University of Wisconsin System
           All rights reserved

 Press <Enter> to begin or <F10> to Exit to DOS...
```

SCREEN II



```
                    TRANSFER INFORMATION SYSTEM
                             MAIN MENU

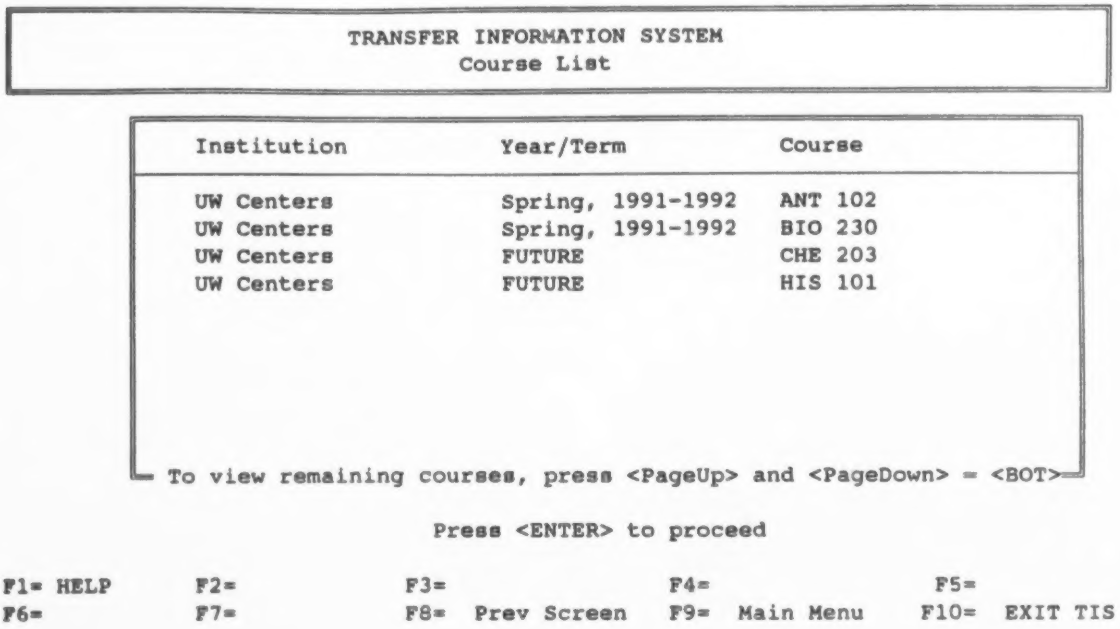
          1.  Transfer of Courses
          2.  Course Information                     (Not Available)
          3.  Institutional Information              (Not Available)
          4.  Academic Programs and Requirements     (Not Available)
          5.  Transfer Progress Review               (Not Available)

          6.  Tutorial
---------------------------- Help -------------------------------------
  1.  Transfer of Courses
      This option provides information on course equivalencies.
      It allows you to see how courses offered at your institution
      will transfer to any UWS institution or how courses taken
      elsewhere will transfer to any UWS institution.

-------------------- Press <ENTER> to proceed. -------------------------

F1= Exit Help  F2=          F3=          F4=          F5=
F6=            F7=          F8=          F9=          F10= EXIT TIS
```

SCREEN III



```
                    TRANSFER INFORMATION SYSTEM
                            Course List

      Institution             Year/Term            Course

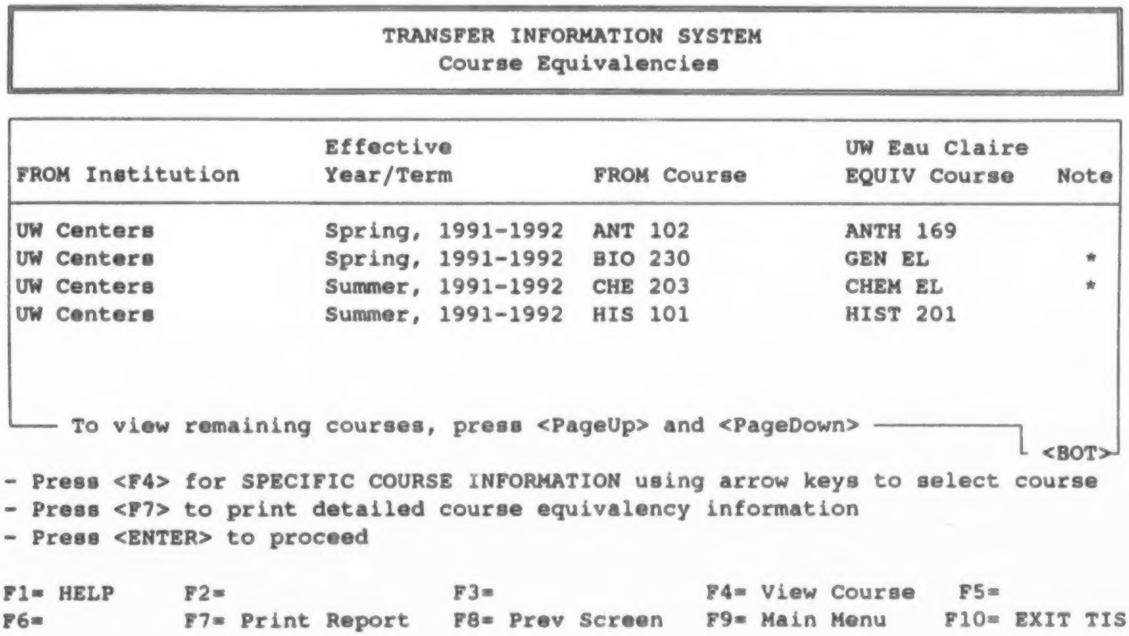
      UW Centers              Spring, 1991-1992    ANT 102
      UW Centers              Spring, 1991-1992    BIO 230
      UW Centers              FUTURE               CHE 203
      UW Centers              FUTURE               HIS 101

 To view remaining courses, press <PageUp> and <PageDown> = <BOT>

                      Press <ENTER> to proceed

F1= HELP     F2=       F3=              F4=              F5=
F6=          F7=       F8=  Prev Screen F9=  Main Menu   F10=  EXIT TIS
```

SCREEN IV



```
                       TRANSFER INFORMATION SYSTEM
                          Course Equivalencies

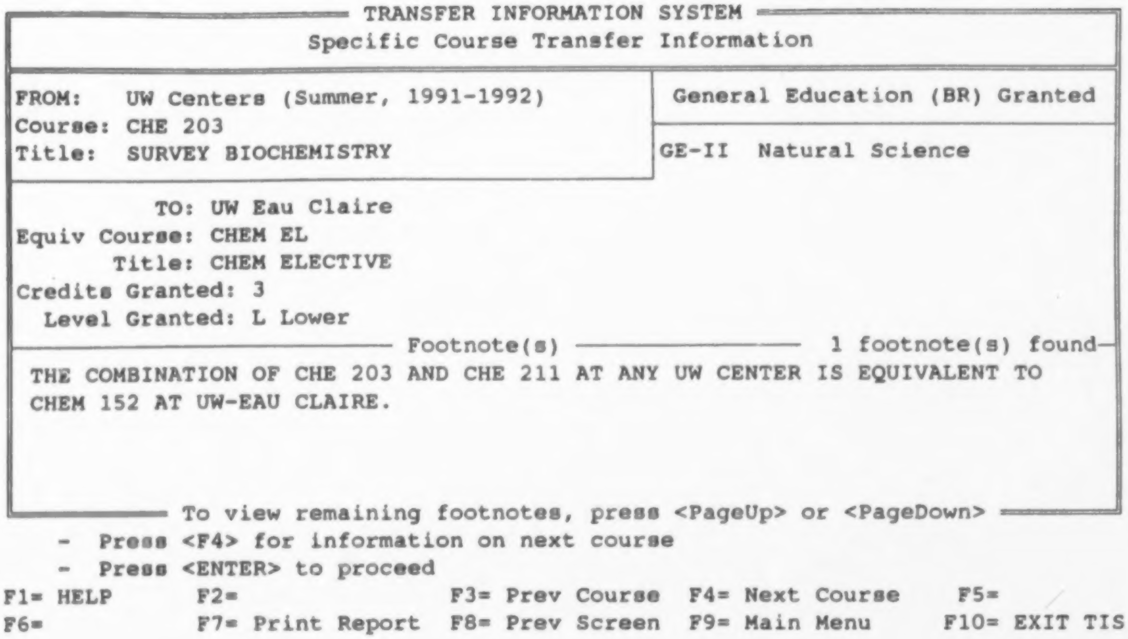
                      Effective                       UW Eau Claire
FROM Institution      Year/Term            FROM Course  EQUIV Course    Note

UW Centers            Spring, 1991-1992    ANT 102      ANTH 169
UW Centers            Spring, 1991-1992    BIO 230      GEN EL            *
UW Centers            Summer, 1991-1992    CHE 203      CHEM EL           *
UW Centers            Summer, 1991-1992    HIS 101      HIST 201

     To view remaining courses, press <PageUp> and <PageDown>
                                                                  <BOT>
- Press <F4> for SPECIFIC COURSE INFORMATION using arrow keys to select course
- Press <F7> to print detailed course equivalency information
- Press <ENTER> to proceed

F1= HELP      F2=               F3=               F4= View Course   F5=
F6=           F7= Print Report  F8= Prev Screen   F9= Main Menu     F10= EXIT TIS
```

SCREEN V



```
═══════════════ TRANSFER INFORMATION SYSTEM ═══════════════
                Specific Course Transfer Information

FROM:   UW Centers (Summer, 1991-1992)   General Education (BR) Granted
Course: CHE 203
Title:  SURVEY BIOCHEMISTRY              GE-II  Natural Science

           TO: UW Eau Claire
Equiv Course: CHEM EL
       Title: CHEM ELECTIVE
Credits Granted: 3
  Level Granted: L Lower
──────────────── Footnote(s) ──────────── 1 footnote(s) found─
 THE COMBINATION OF CHE 203 AND CHE 211 AT ANY UW CENTER IS EQUIVALENT TO
 CHEM 152 AT UW-EAU CLAIRE.

════ To view remaining footnotes, press <PageUp> or <PageDown> ════
    -  Press <F4> for information on next course
    -  Press <ENTER> to proceed
F1= HELP       F2=            F3= Prev Course  F4= Next Course    F5=
F6=            F7= Print Report F8= Prev Screen  F9= Main Menu    F10= EXIT TIS
```

SCREEN VI

```
 2/05/92                                               TRANSFER INFORMATION SYSTEM                                     Page 1
13:39:16                                           Detailed Course Equivalency Report

STUDENT NAME:      SUSAN STUDENT
TRANSFERRING FROM: UW Centers
TRANSFERRING TO:   UW Eau Claire

Spring, 1991-1992

     UW Centers                                       UW Eau Claire                                   Cr  Lvl  GE
     Course           Title                           Equiv Course     Title                        --- Granted ---   FN
     ------------------------------------------------------------------------------------------------------------------
     ANT 102          ARCHLGY & PREHIS WLD            ANTH 169         INTRO TO ARCHAEOL               3.00  L   *
     BIO 230          BIOL REVOLTN:DESTINY            GEN EL           GENERAL ELECTIVE                3.00  L   *     **

     * - GENERAL EDUCATION/BREADTH:

          Course          GE Granted
          ------          ----------
          ANT 102         GE-III =  Social Science
          BIO 230         GE-II =   Natural Science

     ** - FOOTNOTES:

          BIO 230         BIOLOGY MAJORS SHOULD CONSULT WITH THE BIOLOGY DEPARTMENT AT UW-EAU CLAIRE TO DETERMINE HOW THE COURSE MAY
                          APPLIED TO REQUIREMENTS IN THE MAJOR.

FUTURE

   Effective          UW Centers                                 UW Eau Claire                                   Cr  Lvl  GE
   Yr/Term            Course           Title                     Equiv Course     Title                        --- Granted ---   FN
   ----------------------------------------------------------------------------------------------------------------------------------
   Summer, 1991-1992  CHE 203          SURVEY BIOCHEMISTRY       CHEM EL          CHEM ELECTIVE                 3.00  L   *     **
   Summer, 1991-1992  HIS 101          US HIST TO CIVIL WAR      HIST 201         U S TO 1877                   3.00  L   *

   * - GENERAL EDUCATION/BREADTH:

        Yr/Term            Course           GE Granted
        -------            ------           ----------
        Summer, 1991-1992  CHE 203          GE-II =   Natural Science
        Summer, 1991-1992  HIS 101          GE-IV =   Humanities

   ** - FOOTNOTES:

        Summer, 1991-1992  CHE 203          THE COMBINATION OF CHE 203 AND CHE 211 AT ANY UW CENTER IS EQUIVALENT TO CHEM 152 AT
                                            UW-EAU CLAIRE.

Lvl = LEVEL:
           P = Preparatory/Pre-Collegiate/Remedial    Blank = Not Used
           L = Lower              E = Elementary          A = Advanced
           U = Upper              I = Intermediate        D = Intermediate or Advanced

-------------------------------------------------------------------------------------------------------------------------------------
NOTE:      TIS is a transfer information guide for students and staff in the UW and VTAE Systems.  Although the information is intended
           to be current and accurate, it should NOT be considered a contract or a substitute for formal admission procedures.  Course
           transfer information may vary based upon specific majors or programs.  You are encouraged to discuss your specific
           circumstances with an advisor and to periodically refer to TIS for updated information.
```

37th Annual College and University
Computer Users Conference

"Discover New Worlds With Technology"

M3-1
Developing a Degree Audit System

Gary Kramer
Garth Rasband
Brigham Young University

DEVELOPING A DEGREE AUDIT SYSTEM

Presenters:

Gary L. Kramer
Associate Dean

H. Garth Rasband
Assistant Dean

Admissions & Records
Brigham Young University

CUMREC '92
May 3-6, 1992
Miami, Florida

Concepts to be Discussed:

Introduction & Background

- What is Computer-Assisted Advisement?
- Capabilities of a Computer-Assisted Advisement Program
- Why Computer-Assisted Advisement?

Preparing to Design & Implement a Student Academic Tracking System

- Institutional Environment
    - Institutional Philosophy and Procedures to Approve Curriculum, Make Exceptions, Waive or Substitute Courses
    - System to Maintain Curriculum Changes
    - Method to Consistently Identify Courses
    - Format to Identify Program Requirements
    - Role of Integrated Files
    - Definition of Academic Advisement
- Programming & File Design Considerations
    - Purchase vs. In-House Development of a System
    - Programming Considerations
    - File Structures
    - Hardware/Software Concerns
    - Institutional Networking for Computer Development
- Cost Considerations

Developing a Computer-Assisted Advisement System: Seven Design Principles

- Summarize the Major Strengths and Weaknesses of the Present System
    - Review Functions of Documents
    - Review Functions of Personnel
    - Review Costs Associated with Present System
- Identify Objectives of the New System
- Explore Alternatives
    - Review of the Literature
    - On-site Visits to Other Campuses
    - Contact Professional Organizations (i.e., AACRAO, NACADA)
- Identify Limitations
    - Budget Restraints
    - Delivery of Advisement
    - Training Requirements
    - Adequacy of Equipment
- Design the System
    - Form a Development Team
    - Detail Program Specifications (i.e., worse case scenario)
    - Design User Friendly Computer Output
    - Project Costs

    - Submit a Proposal
- Implement the System
    - Develop an Action Plan and Checklist
    - Involve Users
    - Conduct a Pilot Test
- Evaluate the System
    - Program Analysis
    - User Analysis
    - Resource Analysis

Challenges, "Bugs," Persistence, and Enhancements

- Changing Technology
- Problems and Persisting to Improve the System
- Program Enhancements
    - Involving Faculty

I. INTRODUCTION AND BACKGROUND

The principal computer-related academic goal of institutions during the 1970s was to systematize academic records, mainly the transcript. The computer development objective of the past decade has been to establish registration and records systems. However, institutions were delayed in developing computer-assisted advising because of their dependence on computer stored student record systems. For example, in order to print a comprehensive degree audit report, a computer program had to reveal the following:

- general student profile information;
- general education requirements;
- completed education courses;
- major requirements;
- completed major requirements;
- currently enrolled courses;
- transfer classes and credits;
- waived or substituted major courses; and,
- individual student additional major requirements.

Therefore, institutions that have operationalized computer-assisted academic advising have effectively solved the problem by establishing and integrating student academic information files. Thus, the key to generating a comprehensive student progress report is to have in place integrated registration, records, and curriculum files. On many campuses, this is the focus of the 1990s. The student and advisor should know all the important facts that constitute the academic record. They should know which completed courses apply toward academic requirements, and also know how current enrollment applies toward academic requirements.

At many institutions, student information processing has been automated for several years. This processing has included current and historical data about the student. Academic advising data (curriculum files) are a later addition to the student information system. Curriculum computer files contain catalog and monitoring information necessary for curriculum management. The curriculum computer files also include information on currently approved courses; historical course information; and basic catalog information (e.g., college, department, major, degree requirements). The success and efficiency of a computer-assisted advising system depend on careful system planning and properly developed computer files.

Computer-assisted advising has been involved with a number of campus advising problems. For example:

- too much faculty time spent on clerical-type functions;
- complexity of degree requirements;
- higher frequency of changes in degree requirements and curriculum;
- increased student major changes and "stop-outs";
- extended time between student entry and graduation;
- greater number of advising error; and
- petitions for waiver(s)/substitutions(s) of requirements.

Most computer-assisted systems have met and solved these problems. However, a summary from follow-up questionnaires sent to institutions that reported having computer-assisted advising programs (or in the process of developing them) identified several design objectives that not only addressed the above problems but others as well (79 out of 132 surveys were received, for a return rate of 59 percent). Those institutions recognized that identifying objectives was critical to system development. According to questionnaire responses, those persons designing a computer-assisted advising system should include the following objectives:

1. Develop a programmatic comparison of a student's academic record and the degree requirements for that student.
2. Provide an accurate and up-to-date advising information file.
3. Provide a consistent format between catalog, CRT terminal screen, and printed degree audit report.
4. Include all credit: institutional, transfer, Advanced Placement, CLEP, Military, etc.
5. Provide the flexibility of indexed degree programs, individually modified programs, and totally individualized degree programs.
6. Include a means to insert and track waivers and substitutions.
7. Provide capability to track multiple and dual majors.
8. Track university and general education requirements from date of entry; and track

department major requirements from date of official entry into the major.

9. Provide a mini-transcript on the printed degree audit report.

10. Provide flexibility for narrative information.

11. Show prerequisites and qualifying information.

12. Provide instant update capability.

13. Allow student major shopping.

14. Insure simplified data entry procedures.

15. Provide curriculum management information to academic departments.

Before setting up a computer-assisted advising system, it is necessary to define program specifications. Fortunately, university and college personnel who are interested in developing a degree audit system can profit from the study of existing computer-assisted advising programs, particularly their ratio of successes and failures.

In addition to studying existing systems, institutions also should study all degree requirements (regular and irregular) within the university or college. Department heads and deans can help in this process by identifying special needs and changes that are not well known. In fact, the computer-assisted advising concept should be discussed with college and department leaders to gain their support before the project begins. Proper expectations should be identified, and a representative from each college should be assigned 1) to advise the project team, 2) to critique plans at each stage of development, and 3) to ensure full administrative and faculty support.

Once an institution is ready to implement a program, it should consider doing so in phases, even though all academic programs will eventually be included. Planners should start with a department where success is likely, and rely primarily on students to debug the system, because they are very effective in identifying problems and errors.

Finally, programming success does not always come from the traditional full-time programmer on campus. Most universities attribute their programming success to a dedicated and creative person that perseveres, though the computer problems seem insurmountable. Often the key people are intelligent computer science students that are not restricted by traditional programming methods.

The main concern for institutions should be to make the advising by computer program as useful at the beginning, and during a student's academic life, as it is at the end. For example, most students are enrolled during the semester they graduate; therefore graduation evaluation can be conducted by automatically evaluating current enrollment and all courses completed as they apply to graduation requirements. Thus by methodically outlining and following design procedures, institutions can develop a computerized academic advising report that:

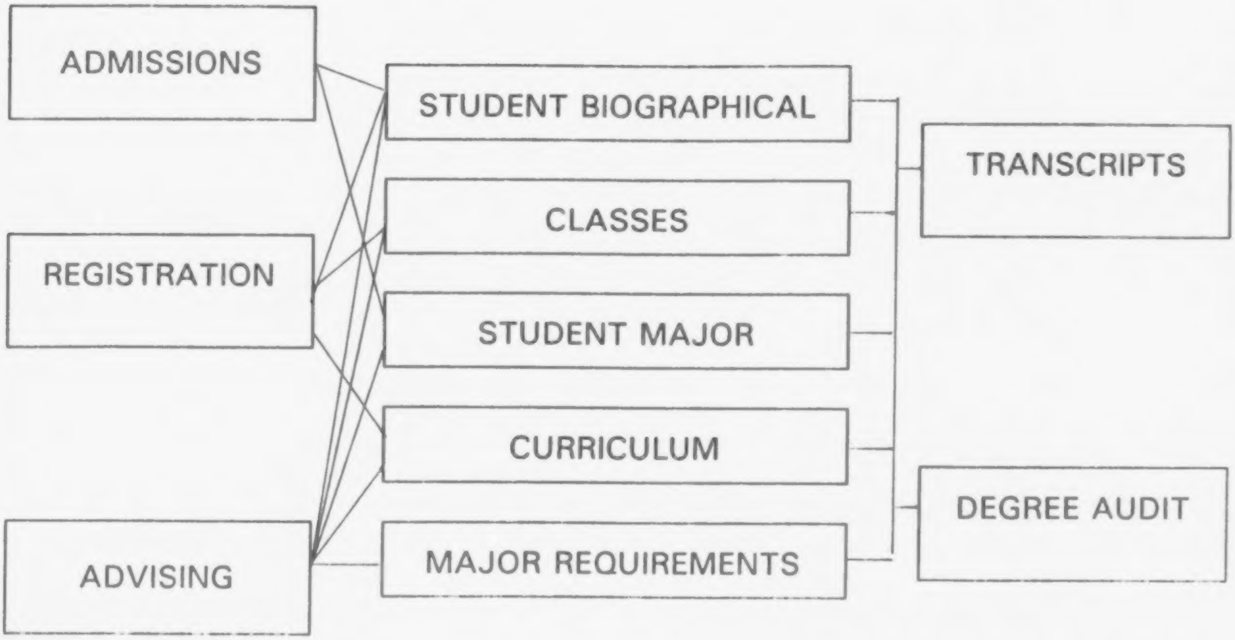
- has the capability to display graduation requirements;
- will match courses completed with those required;
- provides a deficiency/completion analysis of requirements;
- could be used as a tool to certify graduation requirements; and
- automatically generates a posting of the degree to the transcript (Peterson and Kramer, 1984).

WHAT IS COMPUTER-ASSISTED ADVISEMENT?

Computer-assisted advisement is simply a computer program that stores and matches the degree requirements and the student's academic record. The record produced is an evaluation report that shows the graduation requirements and the student's progress in completing those requirements. The progress report may be printed in any number of variations or formats as desired by the university or college. In most cases, the report includes:

1. all requirements for graduation (university, general education, major and specialization);
2. specific courses that will satisfy the requirements;
3. the complete student record of all courses;
4. individual requirements, waiver, or substitutions;
5. additional credit for students--advanced placement, CLEP, military credit, etc.;
6. a statement of proficiency in completing the requirements;
7. who to see and where to go for additional assistance

SYSTEM INTEGRATION (BYU)



ADMISSIONS

REGISTRATION

ADVISING

STUDENT BIOGRAPHICAL

CLASSES

STUDENT MAJOR

CURRICULUM

MAJOR REQUIREMENTS

TRANSCRIPTS

DEGREE AUDIT

COMPUTER-ASSISTED ADVISEMENT

Schools using a computer-assisted advisement program have been able to provide advisors with informative academic requirement reports that are:

1. accurate and up-to-date;
2. less expensive than a photocopy;
3. informative, allowing an advisor to focus on a students's education and career objectives;
4. essential to graduation evaluation;
5. adaptable to any type of advisement (e.g. faculty, advisement centers, peer advisement, or professional advisement);
6. efficient in cutting clerical costs and in giving advisors time to be real professionals

COMPUTER-ASSISTED ADVISEMENT CAPABILITIES

1. State and track all requirements for graduation (university, general, major).
2. Categorize requirements within the major (college, department, major, and specialization).
3. Individually tailor, insert and track an approved degree program.
4. Track the number of classes, number of semester hours and combinations of each.
5. List prerequisites for required courses.
6. Show narrative information.
7. Include all credit, substitutions and waivers (institutional credit, transfer credit, miscellaneous credit such as AP, CLEP, and military).
8. Provide instant update capability.
9. Allow students to "shop" for a major and review immediately change of major consequences.
10. Track requirements as frequently as every semester, but track each student by date of entry into the major, and
11. Track two or more majors.

ADVISING AND TECHNOLOGY

For the student...

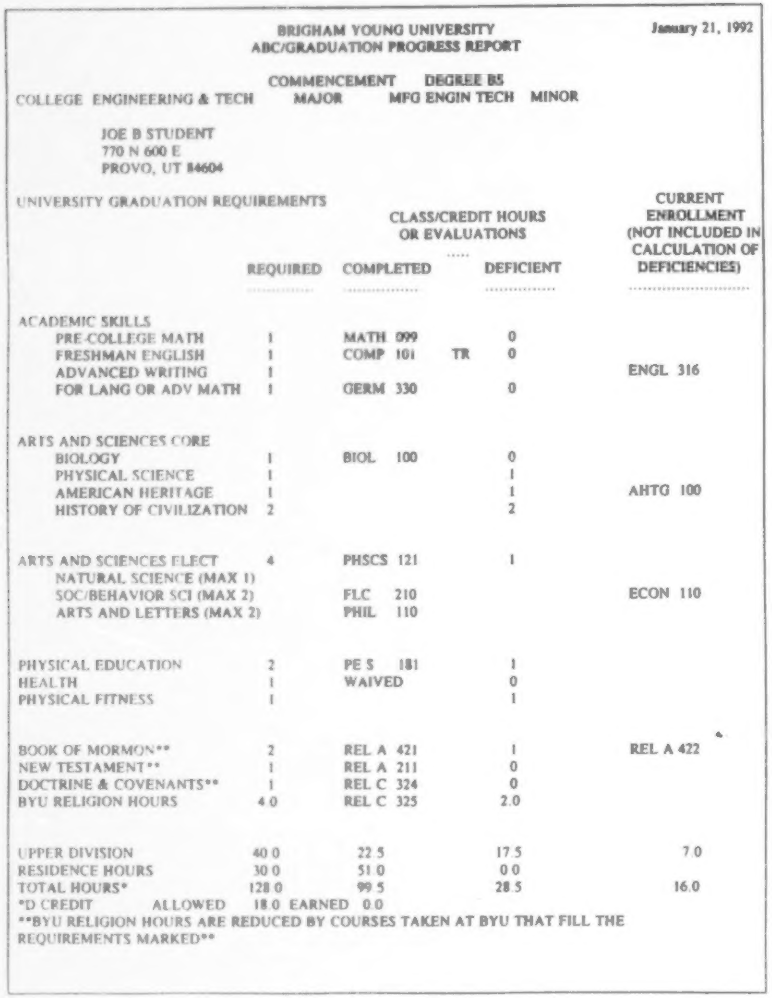
- convenient access to critical planning information
- accurate information
- immediate feedback
- a sense of control in academic planning

For the advisor...

- reduces time in evaluating students for graduation
- improves accuracy of advisement
- simplifies obtaining information on academic requirements
- makes up-to-date information readily available

For the institution...

- clerical relief
- advising professionally
- resource management (people/processing)
- a de-emphasis of bureaucratic tendencies (e.g. lines)



```
                  BRIGHAM YOUNG UNIVERSITY                    January 21, 1992
               ABC/GRADUATION PROGRESS REPORT

                    COMMENCEMENT    DEGREE BS
COLLEGE  ENGINEERING & TECH   MAJOR     MFG ENGIN TECH   MINOR

         JOE B STUDENT
         770 N 600 E
         PROVO, UT 84604

UNIVERSITY GRADUATION REQUIREMENTS                                 CURRENT
                                   CLASS/CREDIT HOURS             ENROLLMENT
                                     OR EVALUATIONS            (NOT INCLUDED IN
                                         .....                  CALCULATION OF
                          REQUIRED   COMPLETED      DEFICIENT    DEFICIENCIES)
                          ........   .........      .........   ..............

ACADEMIC SKILLS
    PRE-COLLEGE MATH          1      MATH  099          0
    FRESHMAN ENGLISH          1      COMP  101   TR     0
    ADVANCED WRITING          1                                  ENGL  316
    FOR LANG OR ADV MATH      1      GERM  330          0

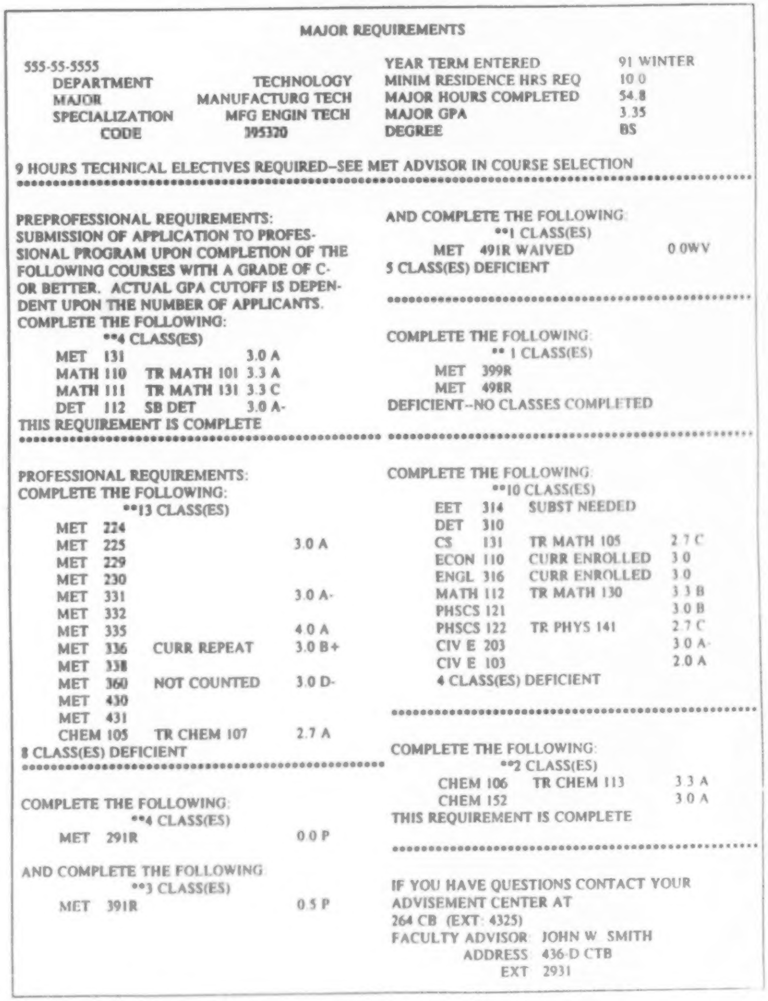
ARTS AND SCIENCES CORE
    BIOLOGY                   1      BIOL   100         0
    PHYSICAL SCIENCE          1                         1
    AMERICAN HERITAGE         1                         1        AHTG  100
    HISTORY OF CIVILIZATION   2                         2

ARTS AND SCIENCES ELECT       4      PHSCS 121          1
    NATURAL SCIENCE (MAX 1)
    SOC/BEHAVIOR SCI (MAX 2)         FLC    210                  ECON  110
    ARTS AND LETTERS (MAX 2)         PHIL   110

PHYSICAL EDUCATION            2      PE S   181         1
HEALTH                        1      WAIVED             0
PHYSICAL FITNESS              1                         1

BOOK OF MORMON**              2      REL A  421         1        REL A 422
NEW TESTAMENT**               1      REL A  211         0
DOCTRINE & COVENANTS**        1      REL C  324         0
BYU RELIGION HOURS          4 0      REL C  325       2.0

UPPER DIVISION             40 0        22 5           17 5            7.0
RESIDENCE HOURS            30 0        51 0           0 0
TOTAL HOURS*              128 0        99 5           28.5           16.0
*D CREDIT        ALLOWED   18.0  EARNED  0.0
**BYU RELIGION HOURS ARE REDUCED BY COURSES TAKEN AT BYU THAT FILL THE
REQUIREMENTS MARKED**
```



```
                              MAJOR REQUIREMENTS

555-55-5555                               YEAR TERM ENTERED           91 WINTER
   DEPARTMENT              TECHNOLOGY     MINIM RESIDENCE HRS REQ     10 0
   MAJOR             MANUFACTURG TECH     MAJOR HOURS COMPLETED       54.8
   SPECIALIZATION      MFG ENGIN TECH     MAJOR GPA                   3.35
        CODE               395320         DEGREE                      BS

9 HOURS TECHNICAL ELECTIVES REQUIRED--SEE MET ADVISOR IN COURSE SELECTION
*****************************************************************************

PREPROFESSIONAL REQUIREMENTS:              AND COMPLETE THE FOLLOWING:
SUBMISSION OF APPLICATION TO PROFES-                **1 CLASS(ES)
SIONAL PROGRAM UPON COMPLETION OF THE          MET   491R WAIVED          0.0WV
FOLLOWING COURSES WITH A GRADE OF C-       5 CLASS(ES) DEFICIENT
OR BETTER.  ACTUAL GPA CUTOFF IS DEPEN-
DENT UPON THE NUMBER OF APPLICANTS.        **************************************
COMPLETE THE FOLLOWING:
         **4 CLASS(ES)                     COMPLETE THE FOLLOWING:
    MET   131               3.0 A                   ** 1 CLASS(ES)
    MATH 110   TR MATH 101  3.3 A              MET   399R
    MATH 111   TR MATH 131  3.3 C              MET   498R
    DET   112  SB DET       3.0 A-         DEFICIENT--NO CLASSES COMPLETED
THIS REQUIREMENT IS COMPLETE
*************************************      **************************************

PROFESSIONAL REQUIREMENTS:                 COMPLETE THE FOLLOWING:
COMPLETE THE FOLLOWING:                             **10 CLASS(ES)
          **13 CLASS(ES)                       EET   314   SUBST NEEDED
    MET   224                                  DET   310
    MET   225                   3.0 A          CS    131   TR MATH 105     2.7 C
    MET   229                                  ECON  110   CURR ENROLLED   3.0
    MET   230                                  ENGL  316   CURR ENROLLED   3.0
    MET   331                   3.0 A-         MATH 112    TR MATH 130     3.3 B
    MET   332                                  PHSCS 121                   3.0 B
    MET   335                   4.0 A          PHSCS 122   TR PHYS 141     2.7 C
    MET   336   CURR REPEAT     3.0 B+         CIV E 203                   3.0 A-
    MET   338                                  CIV E 103                   2.0 A
    MET   360   NOT COUNTED     3.0 D-         4 CLASS(ES) DEFICIENT
    MET   430
    MET   431                                  **************************************
    CHEM 105    TR CHEM 107     2.7 A
8 CLASS(ES) DEFICIENT                      COMPLETE THE FOLLOWING:
*************************************               **2 CLASS(ES)
                                               CHEM 106    TR CHEM 113     3.3 A
COMPLETE THE FOLLOWING:                        CHEM 152                    3.0 A
          **4 CLASS(ES)                    THIS REQUIREMENT IS COMPLETE
    MET   291R                  0.0 P
                                           **************************************
AND COMPLETE THE FOLLOWING:
          **3 CLASS(ES)                    IF YOU HAVE QUESTIONS CONTACT YOUR
    MET   391R                  0.5 P      ADVISEMENT CENTER AT
                                           264 CB  (EXT: 4325)
                                           FACULTY ADVISOR:  JOHN W. SMITH
                                                   ADDRESS:  436-D CTB
                                                       EXT:  2931
```

555-55-5555

CURRENT ENROLLMENT
WINTER 1991

ECON	110	001	3.0	MET	490R	001	2.0
ENGL	316	003	3.0	REL A	422	002	2.0
AHTG	100	001	3.0	MET	336	001	3.0

UNOFFICIAL TRANSCRIPT

TRANSFER CLASSES
UNIV OF ILLINOIS
ATTENDED 84-86

CHEM	107	2.7 A
GER	202	2.7 A
MATH	101	3.3 A
GER	201	2.7 P
ENGR	150	2.0 A
CRJ	101	2.7 A
GER	203	2.7 A
CHEM	112	3.3 B
COMP	101	2.7 C
CHEM	113	3.3 A
COMP	102	2.7 C
GER	221	2.7 B
MATH	130	3.3 B
MATH	131	3.3 C
MATH	195	2.7 C
PHYS	141	2.7 C

BYU CLASSES
SPRING TERM 1987

DET	212	3.0 A-
MATH	099	0.0 P
PHSCS	121	3.0 B
REL C	324	2.0 A

SEM GPA 3.51

SUMMER TERM 1987

FLC	210	3.0 A
MET	131	3.0 A
PE S	181	0.5 B
REL C	325	2.0 A

SEM GPA 3.94

FALL 1987

BIOL	100	3.0 A
CIV E	103	2.0 A
GERM	330	3.0 A-
REL A	211	2.0 A
REL A	421	2.0 A-
MET	291R	0.0 P

SEM GPA 3.88

WINTER 1988

CIV E	203	3.0 A-
MET	225	3.0 A
MET	331	3.0 A

WINTER 1988
(CONT)

MET	335	4.0 A
MET	336	3.0 B-
MET	391R	0.5 P

SEM GPA 3.78

SPRING TERM 1988

MET	360	3.0 D
CHEM	152	3.0 A

SEM GPA 2.85

SUMMER TERM 1988

PHIL	110	3.0 B-

SEM GPA 3.40

SUMMARY OF COLLEGE CREDITS

	EARNED	GRADED	POINTS	GPA
TOTAL	99.5	96.3	332.20	3.45
BYU	54.0	53.5	195.80	3.66

II. PREPARING TO DESIGN AND IMPLEMENT A STUDENT TRACKING SYSTEM

The success and efficiency of a computer-assisted advising system depend on careful system planning and properly developed computer files. A curriculum management system and an integrated student record system must be in place before computer-assisted advising can succeed. Other systems that should be in place are the classroom scheduling and timetable system, registration, and graduation.

The question, "Should we develop computer-assisted advisement at our own university?" perhaps needs to be restated as: "When will my institution implement such a program?" Computer-assisted advisement is indeed the best solution to the most fundamental advisement problem--getting accurate academic information to advisors.

In summary, whether planning to develop a degree-audit system or seeking to refine a present system, consider the following points.

#1 Define Purpose/Mission of Academic Advising

First and foremost, carefully and comprehensively define the role of academic advising in the institution. With clear policies/rules in place, user need and computer ease are facilitated.

#2 Integrate Academic Information Files

Establish operable files for records, registration, and admissions and then establish and integrate a curriculum or advisement file. Both the student and the advisor want to know all factors that comprise the academic record (transfer work, substitutions, waivers, exams). The key is to interface all fields that comprise an academic record and thereby achieve a comprehensive student progress report. Institutions with systems that are effective today in computer-assisted advising are those that have integrated academic information files (that is, registration, admissions, curriculum, records, and the student basic).

#3 Define Clearly Curriculum Management

A good curriculum management system can be divided into three logical files: (1) information necessary for currently approved courses, (2) historical courses, and (3) catalogue information relating to courses.

The curriculum computer files must contain all catalogue information plus other monitoring information necessary for curriculum management. Generally, the curriculum computer files include the following information:

1. *Currently approved courses:* department name, catalogue number, record sequence, credit hours, lecture hours, lab hours, college and department assignment, effective years and terms, optimum minimum and maximum size, course title, semesters or terms offered, effective grade rule curriculum identification number, class fee, special enrollment

approvals, lab or quiz section approval, class type, and last action date.

2. *Historical course information:* curriculum identification number, title code, department name, catalogue number, course titles, effective years and terms, credit hours, grade rule, number of students, last change date (The curriculum descriptions include department names/catalogue number, curriculum ID, from term/year, title, prerequisites, description, date when last revised.)
3. *Catalogue information:* college department major, specialization, degree requirements, prerequisites, narrative statements, effective catalogue year.

The curriculum management file, along with the degree requirements in the student-assisted advisory programs, can also be useful to departments in their curriculum planning. For example, if the system has a file containing the number of students who have officially declared a major in accounting, the courses they have completed, their current enrollment, and their class standing, the curriculum planners in the accounting department can compare their file to the degree requirement file to determine how many sections of each class they must offer and how many student spaces they must provide in the coming term, semester, or year.

The on-line curriculum management system can provide decentralized updating and maintenance throughout the colleges or departments. The system should include the proper edits and checks, according to institutional or college policy.

Just as a caring, knowledgeable advisor is the heart of an advisement program, so is the curriculum to a computer-assisted advisement system. A clear philosophy of curricular decision-making and a definition of how the curriculum system is to be updated are crucial. Before deciding whether to decentralize or centralize, consider: a) resources to hire and train one person or several; b) the coordination and distribution of the report; c) the procedures to resolve discrepancies. A well-trained and knowledgeable terminal operator responsible for inserting academic requirements is central to the success of the advising report.

#4 Track Academic Requirements

Sensitivity to the institution's current methods of tracking academic requirements, to current report formats, and to ideas from faculty, administrators, advisors, and computer personnel can make the designers' jobs much easier and more successful. Can the designers convert current tracking methods to a computer program? Can the computer produce reports in the current formats? The challenge is to produce a computer-tracking document that is familiar to its users. For example, the organization of degree requirements in the catalogue could be the first clue to what the college community finds comfortable and likes to use to describe its requirements. Furthermore, the involvement of faculty, college administrators, advisors, and computer personnel gives these users a feeling of ownership of the report. The committee that develops a computer-assisted advising program should realize that the greater the efforts to understand and work within the present format of academic requirements and to involve the program's users, the greater the possibility to win acceptance of the computer-generated report. Frequently, a user rejects a new report because it is in a format not readily understood. And in designing computer-assisted advising programs, many institutions changed a cold faculty reception to a warm one simply by redesigning the output to appear similar to previous degree audit forms.

#5 Curriculum ID

The most important element in a degree audit system is the concept of a curriculum unit. Catalogue numbers and course descriptions change over time, though the course remains essentially unchanged in content; that is, the course represents the same curriculum unit. The most prominent example is freshman English. During a few decades, the course number for freshman English may have evolved from English 1 to English 10, English 15, English 100, English 101, English 105, English 110, English 111, and finally English 115, while credit hours and content have remained basically the base. It still constitutes a single curriculum unit. A unique curriculum identification number embedded in the class record--for example, freshman English curriculum identification number 1144--eliminates the requirement of maintaining a table to identify the course history with equivalency.

The curriculum identification number can also facilitate the integration of transfer work. The visual information in the system, such as department abbreviations, course numbers, and course title, can remain exactly as it appears on the transfer transcript. But a curriculum identification number, embedded in the transfer class record, can be immediately integrated and recognized in the degree audit and computer-advising programs.

Another design consideration that makes a computer degree audit system more effective is the use of groups in the statement of degree requirements. The statement specifies whether all the classes of that group must be completed or only a certain number of them, whether a certain number of credit hours in the group need to be completed, or is there is a combination of classes and credit hours. These groups can be combined with "and's~ and "or's."

#6 Evaluate the System Periodically

Solicit feedback from all users of the system--refine it! Computer-assisted advisement is a great tool yet it is not a panacea. One might think that students who have received a computer-generated advising report have been advised. Such is not the case. Monitoring academic requirements is no more than half the responsibility of advising students. Advising personnel must still be available for, knowledgeable about, and interested in helping students. The personable, caring approach to academic advising is essential.

Computers cannot replace people as advisors; there is no such thing as "computer advising." But, accompanied by personal advising, the use of computers has demonstrated efficiency and program improvement. Advising by computer can be an effective tool in assisting students and advisors to know and monitor academic requirements. It can relieve much of the clerical burden of the academic advisor. Yet we must keep in mind these words from Albert Einstein:

> "The concern for man and his destiny must always be the chief interest of all technical effort; never forget it among your diagrams and equations."

Advisors should provide students access to important information critical to academic decision-making--that's where computer assistance plays a significant role. Just as important, however, is access and the opportunity to consult with an academic advisor--that's where people come in.

III. DEVELOPING A COMPUTER-ASSISTED ADVISEMENT SYSTEM: SEVEN DESIGN PRINCIPLES

Review and Evaluate the Present System

Begin by stating the objectives of your present advisement system. How well does it fulfill the established program objectives? Three areas of review are suggested: documents, personnel tasks, and costs.

Review documents. List all incoming documents; identify their source and frequency. Prepare a flow chart for each incoming document from its original source, through processing steps, filing and storage. Next, list all outgoing documents or communications and identify their frequency. Again, prepare a flow chart for each outgoing document, identifying processing steps to the point of dissemination. List all processing functions for incoming and outgoing documents, and identify the number of documents being processed at each station, including the time required for each process. Identify bottle-necks or delays in current work flows. Record number of telephone and walk-in inquiries per day, week, month, and year; catalog questions into general categories. Do the report forms and the incoming and outgoing documents promote the advisement process, or do they inhibit or impede the system?

It is necessary to review carefully the degree checklists used in the departments and the statements or graduation requirements in the catalog. An analysis should be made of how the degree requirements are stated, such as by classes, by hours, by combinations of classes and hours, by groups of classes versus other groups of classes, prerequisites, minimum GPA requirements, and any unique statements or requirements.

Review personnel tasks. Outline job descriptions and functions performed by each person. Plot on a graph the peaks and valleys of the annual office work load. Identify each public served, the information required to provide the service, and the frequency of the request. In addition, identify all data elements required to perform the services requested, including a description of the source, purpose, and use.

Identify student contacts with secretaries, advisement personnel, and faculty members. Determine where decisions are made and the process when exceptions to standard policies are granted. Identify who determines transfer credit evaluation for university requirements, general education requirements, and major requirements.

Review costs. Identify all costs associated with the present system, including personnel, equipment, processing, supplies, mail, telephone, and physical facilities.

Calculate the general and hidden costs of academic advisement if graduation evaluations are computed by a hand process. The actual cost for each evaluation, including the associated costs for providing information to students, should also be calculated.

Finally, summarize the major strengths and weaknesses of the present system in achieving advisement objectives.

Identify Objectives of the New System (i.e. eliminate fragmentation and duplication, coordinate and integrate related systems)

After reviewing the weaknesses of the present system, obtain from each public served, through a survey or some other objective means, a written statement of needs and wants. Rank the needs by priority, and establish the objectives of the system to be designed. The objectives in developing the system should be to (a) eliminate fragmentation and duplication, (b) coordinate and integrate related systems, (c) streamline procedures, (d) provide decision-making information, (e) use the strengths of the existing system and data, (f) improve services, and, most important, (g) use machines to do what they do best, and free people to do what they do best. Identify and list all information output and services required. Include an identification of all data elements required to support the system and a source for each data entry. Finally, along with considering present needs and goals, anticipate and project future needs and goals.

A computerized system should not only do what the present system does, but it should improve the process. Frequently, individuals designing computer systems simply convert the hand process to a computer process without improving the services of the system. Identify ways in which the available information can improve service and management decisions. The computer system, for example, should be flexible enough to tap the data base and generate essential reports requested by department chairmen, faculty, and other advisers.

Explore Alternatives

Why reinvent the wheel when it already exists? A variety of exploration activities will help in the development of a computer-assisted advisement program. These include reviews of literature (journals, conference reports, and other related publications), (b) on-site visits to other campuses or businesses, (c) brainstorming sessions with appropriate publics, (d) gathering information about programs that can be purchased, and (e) contact with American Association of Collegiate Registrars and Admissions Officers Machine Records and other consultant services to identify available programs and services.

Several universities have now developed computer-assisted advisement. Each has taken a slightly different approach with different philosophies and costs. These institutions identified specific objectives that guided the establishing of their computer-assisted advisement programs, the process of implementation, and evaluation of the system. Also, these institutions have learned from their mistakes and are willing to share what they would do differently if they were starting over again. Take advantage of this information (Peterson & Kramer, 1981).

This step in program development may provide meaningful information, but be cautious. It is a mistake to assume that what worked well at one institution is transportable to another; this is obviously not the case. Adaption, rather than adoption, is more realistic.

Identify Limitations

With steps 1 through 3 completed, it is time to identify the unique characteristics and needs of your advisement program and to assess how effectively they are being met, to analyze "what is" and "what ought to be. What is wanted and what is feasible, practical, and essential merge clearly.

Before proceeding with the next step, assess possible limitations. For example, ask and then address appropriately the following: (a) Does a definitive advisement policy coordinated with an advisement system exist? (b) What are the existing budget restraints? (c) Are the physical facilities adequate to carry out the functions of a computer-assisted advisement system? (d) How and when will training of personnel occur? (e) What time constraints exist? (f) How available and adequate is equipment to perform the needed functions? (g) Is the flow of data processing clear?

Design the System

Precisely stated objectives are essential to the model design. Knowing what is wanted and what is essential when talking to computer programmers who deal and live in a world of specifics is critical to successful and expeditious program development. Equally important to is the formulation of a development team, composed of faculty, advisement, and computer personnel.

The team can identify necessary data elements, their sources, and methods of input. Program specifications, procedures, timing, and scheduling should also be clearly identified. In addition, the team should format terminal screens and incoming and outgoing forms, reports, and documents. Each step of development should seek feedback from advisers, faculty, and students as to design and usability.

Typically, computer programs have "tunnel vision" in their approach to programming. The user should be careful in designing the system so that it meets user needs and not simply computer programming ease. For example, a user thinks in terms of student's names; computer programmers think in terms of numeric ID numbers. The user frequently relies on the programmer to do a major part of the design rather than providing the design and having the computer programmer provide programming to meet the specifications of the design.

The most common feedback of computer programmers is "it can't be done, or "it costs too much." The user frequently must ask the programmer how it can be done less expensively. In one example, the computer programmers projected the processing cost of an advisement sheet to be at least one dollar. Had they programmed in the manner they were thinking it would have cost that much. Another programmer, who stated that it was too costly but also questioned whether there was another way to obtain the same results at a less expensive price, creatively took a new approach that provided the same results at 1.5 cents per page--less than the cost of duplicated piece of paper.

Design the computer output to the same format that advisers are already used to having. Frequently a user rejects a new report because it is in a format that he does not understand. Many institutions, in designing their computer-assisted advisement program, changed a cold faculty reception to a warm faculty reception by simply redesigning the output to appear the same as the previous end degree audit forms.

Finally, project costs for development and maintenance of personnel, processing, supplies, physical facilities, and equipment. All of the above information should be compiled, documented, put into proposal form, and submitted for administrative approval before actual resources are committed to program implementation.

Implement the System

After approval but before implementation, develop an action plan and checklist, including an established timetable for implementation. Users should be consulted concerning the timetable or action plan, especially on the training and work load of personnel.

The checklist should determine whether (a) a written outline of academic requirements is on file, (b) degree requirements are entered in the computer, (c) both written degree requirements and computer-entered degree requirements will be reviewed for accuracy and compatibility, (d) appropriate academic personnel (e.g., deans, department chairs) are familiar with the capabilities of the program design, (e) certification of document accuracy by academic personnel is on file, and (f) adequate feedback on document accuracy has been obtained from students and advisers.

Before full implementation of the computer-assisted program begins, conduct a pilot test on all program specifications, including the matching of degree requirements with students by department and backup and recovery procedures.

Evaluate the System

Review of the computer-assisted advisement program should include three areas of analysis:

Program analysis. Ascertain error rate of data input, efficiency evaluation for personnel, and machine and program accuracy.

User analysis. Obtain administration, student, and faculty responses to the system.

Resource analysis. Review the use of staff, materials, funds, facilities, and equipment. Key elements of the evaluation process should include a review of accuracy of the data, efficiency of the system, error rate, discrepancies reported, and speed in obtaining an academic advisement report (Spencer, Peterson, and Kramer, 1983).

IV. CHALLENGES, "BUGS," PERSISTENCE, AND ENHANCEMENTS

In addition to the discussion on problems, "bugs," and persistence, this section will also cover the following enhancements: computer-assisted faculty advising, freshman profile, automated transfer evaluation, and graduation evaluation that stem from a computer-assisted advising system.

A. Using Computer Technology to Aid Faculty Advising

Through in-place technology, the ABC Progress Report and its integrated files, computer-aided faculty advising does the following:

1. Consistently informs students who their assigned faculty advisor is and thereby brings faculty and students closer together so that students (a) might receive advising in their major and professional direction in their career choices, and (b) become acquainted with faculty in their field.

2. Helps let students know who their faculty advisor is before they enter the university.

3. Inserts the faculty advisor's name, address, and phone number on student ABC Progress Report.

4. Keeps the faculty advisor up-to-date on the number of advisees.

A faculty advisor file has been designed to build individual information on each faculty advisor selected by the department and assigned to advise students. The new file, created from information submitted by each academic department and based on an assigned advisor code, lists specific demographic data about the faculty advisor and notes the advisor's area of expertise within the academic discipline--information important in making a wise, accurate faculty-student assignment. This file generates a list of all assigned faculty advisors by department and expertise.

Computer-aided faculty advising communicates regularly to students who their faculty advisor is and where the advisor is located. Similarly, faculty advisors, thanks to the advisor-advisee computer generated report, are aware of assigned advisees. The computer-aided advisor system also allows academic departments or advising centers to maintain, update, and monitor advisor-advisee files.

The advisor file system's most attractive feature is its flexibility in making advisor-advisee assignments. The department administrator can preselect faculty to advise on the basis of academic expertise, and the advisor can be matched to the background and interest of the advisor according to his or her needs. For example, advisor-advisee assignments could be based on student academic standing (from probation to honors); academic class (from Freshmen to Ph.D. candidate); teacher certification interest; new transfer status; older/reentry students; students uncertain about their major selection; handicapped students; foreign or minority students.

Computer-aided faculty advising is a good compromise between mandatory advising and no required faculty-student relationship. Computer-aided faculty advising influences the frequency of contact between advisor and advisees, and this provides precise information on who is advising whom, while efficiently assigning faculty advisors to students.

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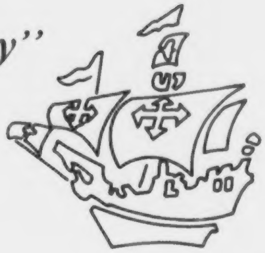

M3-2

Implementing Distributed Financial Information Systems at Indiana University

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Implementing Distributed Financial Information Systems at Indiana University

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Introduction

The Financial Information System is one of the cornerstones of administrative information systems in the university. Access to financial data in a timely way is crucial to departments being able to manage their individual units in a Responsibility Center Management environment. The ability to capture data at the source, to manage local data locally, while being able to transparently interact with non-local data are all requirements for this environment. Vendors today are offering new tools and technologies to meet these needs in a distributed environment.

This paper discusses the various components of the new Financial Information Systems and how these neatly integrate with the strategic directions of the University Computing Services organization. Access to financial data by all eight campuses of Indiana University, as well as a robust on-line transaction processing environment for data capture at the source of collection are a baseline requirement for this system. Covered is an implementation schedule for the system and its associated technologies.

Indiana University...a time of transition

Indiana University is moving towards a radically different method for planning and operating the various entities within the institution. The concept, called Responsibility Center Management (RCM), places the responsibility for funding and expenditure with each Responsibility Center. The Richmond Campus of the institution, the School of Business and the University Physical Facilities Unit are examples of RCs. For instance, in the case of the School of Business, it is expected to fund itself from student fees, research grants, gifts and other fund raising methods. An RC may carry surpluses from year to year but must carry deficits forward as well, balancing its budget in the current period by "borrowing" from the institution at the going cost of capital rates. With the advent of this RCM philosophy and the realization that the institution is operating in an era of critical resource constraints, Indiana University faces a significant challenge in facilitating the way in which it needs to manage its financial activities.

A New Financial Information System for IU

As the unit responsible for financial information processing at IU, the Financial Management Support (FMS) department has embarked on an initiative to address these needs. Utilizing powerful but cost-effective new technologies, such as the high-speed network being deployed around the state, the workstation devices being attached to it, and emerging relational database tools, Indiana University feels it can develop effective financial information systems to address what many agree are these shortcomings of the current environment:

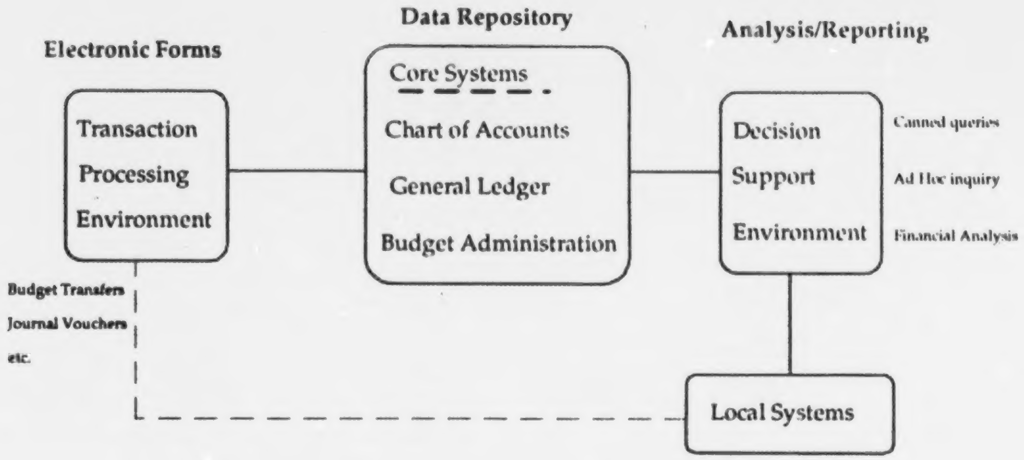
- Financial data are scattered among many different files, resulting in limited and difficult access; dictionary information about the data is not always available.
- Computer programs that link these data are aging, complicated and inflexible, and therefore difficult and expensive to change and maintain.
- The impact of a transaction on a unit's financial position is not immediately available to an account manager.
- Responsibility Center Management has created new needs not easily met by current systems or data structures.
- Paper is still the norm for the creation of financial data.
- Planning and forecasting activities are difficult to perform, at best.

Mindful of the above and of the resource constraints under which it operates, FMS has developed a model, shown on the next page, of how the **F**inancial **I**nformation **S**ystems (**FIS**) of the nineties will look at Indiana University. Please note that this is not a flow diagram. It is intended only to depict the major components of the system and how they are related.

The model breaks the financial process into three separate but interdependent functions:

- **Transaction Processing** ---- those services which enable the processing of individual (or multiple) "transactions." Examples would include such things as: performing a budget transfer; paying a faculty or staff member; approving an invoice; appointing an employee, etc.
- **Core System Functions** -- the internal (to FMS and UBO) process of managing the general ledger and budgeting functions via the initial recording of financial transactions and the transfer of data created during the Transaction Processing procedures to the Financial Analysis databases.
- **Decision Support (Analysis, Reporting and Planning)**---those services that facilitate the management of a department's or Responsibility Center's account(s). This would include such things as: the development, administration and presentation of a set of integrated financial databases; decision support tools and services; the production of required internal and external financial reports, etc.

Financial Information Conceptual model


Data Repository
Electronic Forms
Analysis/Reporting
Core Systems
Transaction
Processing
Environment
Chart of Accounts
General Ledger
Budget Administration
Decision
Support
Environment
Canned queries
Ad Hoc inquiry
Financial Analysis
Budget Transfers
Journal Vouchers
etc.
Local Systems

Graphical user Interface (GUI) based system

Local (workstation or LAN based systems) will be integrated into the system as the user desires. The Graphical User Interfaces (GUI) used, (MAC and Windows 3.x) provide the standards by which this will be enabled. It is only by using these standards based environments that we can offer true integration for many users. It will, of course require they users of these tools, but the FIS is in part premised on the fact that departments at the institution are voting for Windows and MAC with their hardware and software budgetary resources. We are, in essence, guided by their choices here. Our intent is that the FIS look and feel like any other 'shrink wrapped' graphical application they may have purchased for their own desktop workstation. In this way, we minimize the learning curve and in fact restrict it to the functional arena for those who are already users of the GUI.

The development of this system involves a partnership among FMS, its service recipients and the technology organizations (University Computing Services (UCS), IUPUI Computing Services and the Campus Computing Centers at the regional campuses). An **FIS Steering Committee** consisting of senior administrators from all eight campuses is providing the needed guidance throughout the development and implementation of the entire system.

The guiding principle at work here is that FMS will distribute much of the management of financial information to the operating units (RCs). Its role will be that of data stewardship, overall coordination, consulting, and the delivery of official institutional reports, both internal and external.

The design objectives of the FIS can be summarized thus:

- deliver user-friendly, timely and effective financial transaction processing services to faculty and staff;
- provide financial decision support tools to account managers and others to facilitate effective financial management, planning and forecasting;
- reduce the paper flow and lengthy approval cycle associated with many of the current financial processes;
- leverage the technology architecture being advocated by University Computing Services;
- where appropriate, utilize the Graphical User Interface and multimedia capabilities of the desktop computer to deliver an easy to use suite of services.

Technologies being implemented

The technological infrastructure being implemented by UCS provides an excellent foundation for the FIS. Before we discuss this infrastructure, a brief background will help to put things into perspective. University Computing Services was formed in early 1989 with the merger of the Bloomington Academic Computing Services (BACS) organization and Information Services, the administrative computing organization. This merged organization is responsible for academic computing support on the Bloomington campus and university wide support for administrative computing.

The former Information Services organization used the SNA network protocol while the BACS organization employed DECNET and Sytec primarily. The new UCS organization developed a policy and plan to move towards an open network architecture, employing TCP/IP as the backbone transport protocol. With the diverse hardware and systems at IU, this network held the promise of access for all users. Faculty and students who were previously unable to access records on the traditional administrative IBM mainframe would now be able to do so.

We have come a long way towards the implementation of this dream. The Bloomington campus has been completely wired with FIBER cable over which is running Ethernet using TCP/IP. On the main campus of Indiana University we are in the final year of a two year project to connect most academic and administrative units to the TCP/IP network. At the completion of the project in September of 1992, we expect to have over 6000 faculty and staff connected.

On all campuses of the IU system, projects are underway to provide connections to the network. Some campuses are ahead of Bloomington, others are a bit behind. Through state legislative funding assistance, we hope to have all faculty and staff, system-wide, connected to the network by 7/1/93.

Many administrative systems, including the purchasing system, statement of accounts, student advising, student scheduling, the entire information center as well as libraries, are now available over this open network. Traditional administrative users are also migrating to the TCP/IP network in order to access more services than are available via SNA. We are addressing questions of security, 3270 emulation, user-friendly appearance of the transactions, and access authorization. The new financial information system will rely exclusively on this open network.

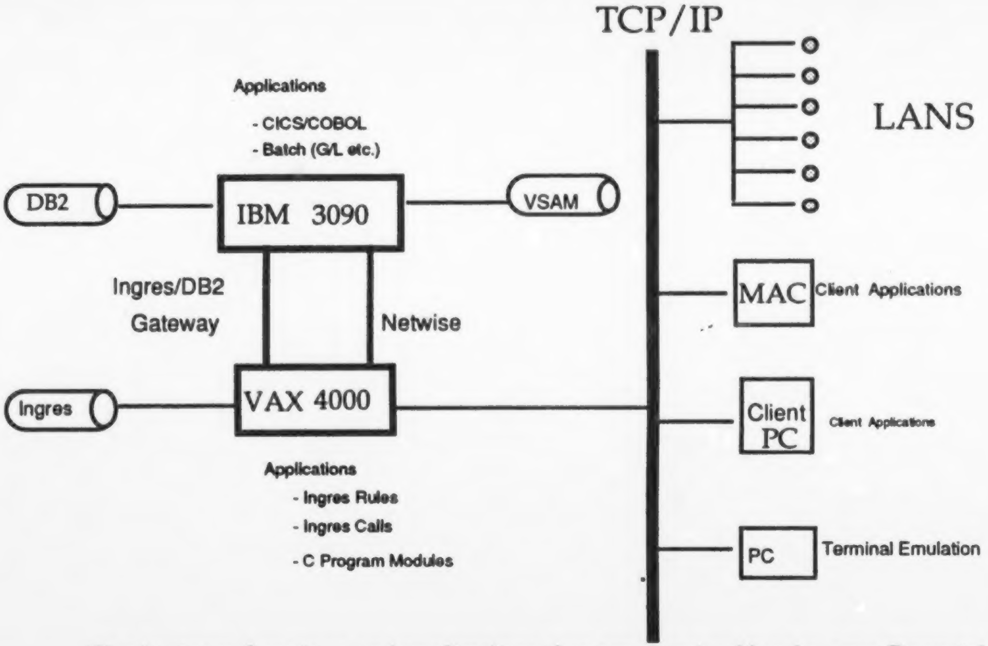
University Computing Services committed to a relational database structure in December of 1990 and has since then implemented DB2 for the IBM mainframe. We currently have nineteen tables and three production applications using DB2. We are in the final stages of converting our largest information center VSAM file, the employee database, to DB2 to facilitate access to those data. We see the use of DB2 as a file server for institutional data for all campuses of IU.

In addition, we have investigated, evaluated and declared Ingres as our RDBMS for distributed applications. We have acquired a VMS central server (referred to as the scalable alternate platform) on which Ingres will reside. Our current "information center" customers are using FOCUS to access VSAM files on the mainframe and the FOCUS/DB2 interface to access DB2 files on the mainframe. We plan to architect a new environment on the new VMS/Ingres machine whereby users can access institutional data and where Online Transaction Processing (OLTP) systems can reside.

The toolset that will be available on the VMS machine will include tools for development of the server application and the client application for both windows and non-windows environments. The ideal application development tool would satisfy our "develop anywhere--deploy anywhere" goal. Deployment modes being considered include terminal emulation, character-based GUI, Windows 3.0 GUI and Macintosh. Query tools will facilitate access to the data for the end-user.

Gateways from this platform to the IBM3270 mainframe will allow both ad hoc access to DB2 and predefined access to any CICS application. We are acquiring the Ingres gateway to allow access to DB2 files on the mainframe as well as a product to allow access to VSAM files on the mainframe. Acquisition of these gateways will help us to leverage our investment in existing applications and data files and move to the new client/server technologies without migrating applications or files. The figure below shows the application architecture being deployed.

Financial Information System Architecture


TCP/IP
LANS
Applications
- CICS/COBOL
- Batch (G/L etc.)
DB2
IBM 3090
VSAM
Ingres/DB2
Gateway
Netwise
MAC
Client Applications
Ingres
VAX 4000
Client PC
Client Applications
Applications
- Ingres Rules
- Ingres Calls
- C Program Modules
PC
Terminal Emulation

The business functions and applications that are required by the new Financial Information System leverage this technology being rolled out by University Computing Services. The question of whether the business requirements should be driving the technology or whether technology can now give opportunity for delivery of business applications more efficiently and effectively is an interesting one. University Computing Services and Financial Management Support perceive this as a mutual occurrence. We look upon this as a unique opportunity to make this architecture available for mission-critical production applications such as the FIS.

Timeline of services--Technology

University Computing Services has constructed a timeline for the types of tasks in which we are engaged in order to move this environment into production. UCS and FMS are working to align schedules for the roll-out of these applications in a timely fashion.

Already in place are a data administration guidelines document, a data access policy and a data architecture document. After the announcement of the distributed database standard, Ingres, UCS has been working on configuring the hardware platform, which is currently being installed. This month software is being tested on that platform, and plans are to have both gateway products installed in January. The toolset will then be finalized. Change management standards and production implementation standards for this new environment as well as system administration standards and support, are being developed. This will be followed by application development standards and Ingres DBA standards and support procedures. Pilot applications will be done in a March - May 1992 time frame. UCS will then size the hardware for the next several years' anticipated needs and install the required security products. UCS intends to announce the alternate production application environment in the summer of 1992.

Timeline of services--Applications

As the various technology components are put in place, the FIS application will be implemented. FMS and UCS have already completed a conceptual data model for the system using a CASE tool. In addition, specific pilot applications have been designed to calibrate the environment. We have put in place a dedicated project team, made up of FMS, UBO and UCS staff, which will be responsible for the implementation of the projects and the coordination of the various advisory committees. This also includes a learning curve for staff who will be developing and supporting the major parts of the FIS. These pilots will be completed in March-May of 1992.

Transaction Processing

Initial deployment of the Budget Adjustments, Distribution of Income/Expense, Error Corrections, Internal Billings, Hourly Pay Advice, Accrual Entries and Cash Transfers transactions is planned for December 1992.

General Ledger/Budgeting System

Plans call for purchasing a G/L package and the decision date for selecting the specific product is June 1992. Deployment of the G/L will take place in June 1993.

Decision Support

The decision support tools will be introduced as soon as the RDBMS toolset has been selected and will be used in the Tool kit project. As databases are developed for the FIS, these tools will be deployed out to users around the network.

Conclusion

The emphasis in this initiative is to put control of financial information into the hands of the operating unit executives. The financial information system being developed differs from the standard financial information system utilized by many institutions in that it presents two distinct "views" of the system: 1) Transaction Processing where specific sets of financial transactions are performed and 2) Decision Support, where desktop tools are used to facilitate data analysis and reporting. The core part of the system, the standard General Ledger, is unlikely to be of much interest to anyone except the central accounting and budgeting staffs who manage the "books" of the institution.

Implementation of a distributed system of this size is challenging and we are proceeding with caution. We plan to roll out these first few applications by implementing those which are not mission critical and learn from our experiences. The technologies we are using are not yet mature enough to allow total distributed database implementation, but we will use those components of the technology that are ready and position ourselves to evolve with the technology.

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M3-3

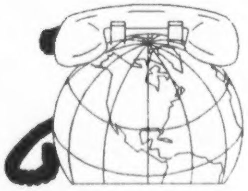
The Electronic Exchange of Student Transcripts Using the National ANSI ASC X12 Standard Format

John T. Stewart
Miami-Dade Community College

THE ELECTRONIC EXCHANGE OF STUDENT TRANSCRIPTS USING THE NATIONAL ANSI ASC X12 STANDARD FORMAT

John T. Stewart
Registrar, South Campus
Miami-Dade Community College (FL)

Introduction



A few decades ago, most institutions of higher education in the country were producing copies of the student academic record (transcript) by some means of photo copying the hard copy student history. The original record for the student may have been typed at the time of admission or perhaps was created by printing it from some punched IBM cards which, in turn, were created at the time of admission. This document was then filed in a master file of all students who had ever attended the institution.

At the end of each term, grade labels were prepared for each student who received grades that term. These labels were then transferred to the cumulative student record for the student. This may have been done by sticking the new label to the cumulative document or by means of a heat transfer process. Although this was labor intensive, it worked. It did take a while after the end of the term for the institution to be certain that all the grades were posted to the correct document. After this was insured, the copies could be made and transcripts could be issued. Corrections to the record (for example, grade changes) were made manually and this complicated the process for keeping accurate cumulative grade average and cumulative credit totals.

By the early 1980's, most technologically advanced institutions had converted from the paper document maintained in the campus registrar's office, to a computer generated document that was maintained on an institutional data base. To produce an up-to-date original document of the student's academic record, the registrar's office merely requested a document to be printed in a weekly or overnight batch job. Now it is quite common for this to be done immediately in an on-line transaction.

Advantages of Electronic Data Interchange

Electronic Data Interchange (EDI) is the computer-to-computer communication of data from common industry or education documents using standard data formats. Standard data formats ensure that different educational institutions can exchange institutional data without having to modify their computer systems or institutional management software.

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In the case of the student transcript, it means that the process of obtaining, evaluating and utilizing student transcripts for a student seeking admission to a postsecondary institution could ultimately be completely automated.

An example is the use of EDI by Miami-Dade Community College in obtaining the high school transcript.

- When the first year student applies to the college, the student's high school is coded and entered into the college's computerized data base (as is the date of high school graduation).
- A batch program is run each week to automatically send a request via the electronic network to each participating high school for all students who meet all the following criteria:
    - High school transcript has not been received, and
    - High school transcript has not been requested within past four weeks, and
    - High school grad date has passed, and
    - High school transcript is needed (degree-seeking, not a transfer student)
- When the transcript is received electronically, it is matched by the computer with the request and the student's record.
- The student's record is updated to show the admissions file is now complete and a few selected data items are moved from the electronic high school record to the college's data base for the student. At the community college, this now fully admits the student.

This process eliminates

- Notices to students asking for the transcript
- The student personally contacting the high school and making a request
- The high school pulling the correct record, making a photo copy of it and paying postage to send it through the US Postal Service

- The college trying to match the transcript up with the student's college file and manually updating the student's record on the college's data base

- Filing the paper transcript in the student folder

- Microfilming the paper transcript when the folder is retired

Of course, similar efficiencies are enjoyed when dealing with student transcripts from other postsecondary institutions.

Although speed of obtaining the student record from the previous school is typically much better than when using the US Postal Service, the real time that is saved is **after** it is received. At that point, all the processing is done automatically by computer programs with no or minimal interaction by clerks in the admissions office.

Electronic Transcripts in Florida and Texas

In the early 1980's, the Florida legislature created a public electronic network for education with the primary purpose of collecting more timely statistical data from the school districts and postsecondary institutions in the state. As the systems were being put in place to collect these statistical data, a group in the state's Department of Education realized that many of the same data elements that had to be standardized and computerized for the statistical reporting purposes were those included on the student educational record (transcript). The President of the Florida Association of Collegiate Registrars and Admissions Officers (FACRAO) at the time came to the same realization. A committee was soon appointed to determine the feasibility of developing a common electronic format for the exchange of student transcripts using the Florida Information Resource Network (FIRN). FIRN was the public electronic network funded entirely by the state legislature. The committee met and two common formats were created (one for the Kindergarten through Grade 12 sector and another for postsecondary institutions).

Several pilot school districts and postsecondary institutions were selected and the exchange of students records using the FIRN network began. As of February 7, 1992, there were 13 of the 67 school districts (19%) in Florida exchanging records electronically with no paper copies of records required. In addition, 16 of the 37 postsecondary institutions (43%) were exchanging electronic transcripts. The state of Florida mandated that all 67 school districts and 38 postsecondary institutions must have had programming in place to exchange student transcripts electronically for high school through postsecondary students by December of 1991. Some severe funding problems in the state have delayed the full implementation but most school districts and postsecondary institutions are making progress toward that goal.

Meanwhile, in Texas, a consortium of postsecondary institutions under the umbrella of the Association of Higher Education of North Texas (AHE), decided to create their standard format and realize the benefits possible by exchanging student records using an electronic format. There are now 20 colleges and universities in Texas that are part of the Electronic Transcript Network (ETN) of the AHE. This network is used daily to exchange sizeable numbers of transcripts over the General Electric Information Service (GEIS) value added network.

AACRAO Gets Involved

At the annual conference of the American Association of Collegiate Registrars and Admissions Officers (AACRAO) in Nashville, Tennessee in April of 1988, there were several presentations about the exchange of student records electronically. During that conference, some informal discussions were held and the feasibility of exchanging records electronically between Florida and Texas was explored. The two formats (Florida and Texas) were quite different. Therefore, a program would have to be written to convert from one format to the other and vice versa. At this time, an AACRAO member from Georgia joined in with information that Georgia was also investigating the implementation of the electronic exchange of student records. It was also learned that the state of California was also exploring the idea. It soon became evident that the conversion of all these different formats would get out of hand.

This small group discussed the potential for the project with the AACRAO Vice-President for Data Management and Research (Gary Smith) who appointed a task force to study the feasibility of a national standard format for the exchange of postsecondary transcripts using one or more electronic networks.

AACRAO Task Force Holds First Meeting

The task force held its first meeting on the campus of Purdue University in West Lafayette, Indiana in January of 1989. The group unanimously agreed that the project was timely, worthwhile and do-able. Much of the initial meeting was spent in preparing a very rough draft of the format. It was also agreed to try to establish an American National Standards Institute (ANSI) standard by working with the Accredited Standards Committee (ASC) X12.

The task force made its first report to the AACRAO Executive Committee in February 1989 and also made a report on its progress to a meeting of the Southern Association of Collegiate Registrars and Admissions Officers (SACRAO) in Tulsa, Oklahoma.

In April 1989, the task force made its first formal report to the AACRAO membership at its annual conference in Chicago. There was a great deal of interest in the project from several representatives of mostly larger institutions.

Task Force Expands and K-12 Task Force Meets

In June 1989, a representative from Canada was added to the task force to give it an international perspective and an official liaison to the task force from CAUSE was appointed.

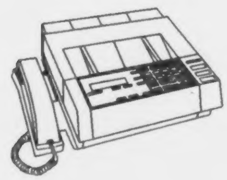
In addition, a new task force was formed to represent the Pre-Kindergarten through Grade 12 sector. This task force was funded by the Department of Education's National Center for Education Statistics (NCES). This task force was composed of representatives from school districts and one consortium from five different states (California, Florida, New York, Texas and Washington). It held its first meeting in Washington, DC.

Also in June 1989, the AACRAO task force officially adopted the name "Standardization of Postsecondary Education Electronic Data Exchange" or SPEEDE.

SPEEDE Task Force Meets with other Agencies

Although the SPEEDE task force was convinced there was a need for the project, it also felt that it was time to inform other AACRAO constituencies about the project. In September 1989, representatives from the two testing agencies (American College Testing and The College Board), the Law and Medical Schools Admissions Services and selected software vendors were invited to join the task force in Las Vegas (on the campus of the University of Nevada at Las Vegas) for a briefing and discussion. All of the invitees were enthusiastic about the project. At this time a subcommittee was also appointed to look into the possibilities of the creation of a data base and coding structure to include all the various educational institutions in the United States (private and public, secondary and postsecondary) and to build a cross-walk among the various coding systems now in use at our institutions.

Concerns with FAX and Athletic Eligibility



There was and still is tremendous interest in the use of facsimile (FAX) transmission of student records. Since FAX deals with electronic transmission of documents and there was no other AACRAO committee to deal with the issue, the AACRAO Board of Directors asked the SPEEDE task force to recommend a policy on the sending and the acceptance of FAX documents. While the task force made its recommendations (which were endorsed by the Board of Directors), the task force tried to deal on a continuing basis with distinction between FAX and EDI. While FAX is a great way to get a paper document from one point to another immediately, the method of Electronic Data Interchange (EDI) allows for this exchange to take place (also immediately) in a form that the receiving institution's computer can process automatically without human intervention.

Another concern was raised about the acceptance of the electronic transcript for official certifications to agencies outside the institution. The first agency contacted was the National Collegiate Athletic Association (NCAA). They responded that they found no problem in accepting a transcript received electronically as an official document for their purposes.

ANSI ASC X12 Sends a Representative to SPEEDE Meeting

At the December 1989 meeting of the task force at the University of Texas in Austin, a representative of the X12 Secretariat joined us for a discussion of our progress in converting our format into an ANSI ASC X12 national standard. At this time, we also decided to attempt to merge the postsecondary and the K-12 formats into one ASC X12 standard.

This new ASC X12 format was quite complicated and both task forces spent a great deal of time and effort to convert our earlier format (primarily composed of a series of fixed length records) into the ASC X12 format which is totally composed of variable length data elements and segments.

Pilot Project Begins and Arizona Project Discovered

Although the task force knew that the student records could indeed be exchanged over electronic networks (it was already being done in Florida and Texas), the group still felt that we needed to test the newly developed national standard to see if schools in Florida and Texas could convert to and from this standard without a great loss of meaningful data. Another goal of a pilot would be to test the exchange of electronic data as it moved to and from one public network (Florida Information Resource Network or FIRN) in Florida to and from the proprietary value added network (General Electric Information Service or GEIS) used by the schools in Texas.

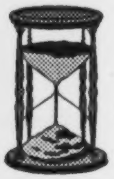
So a pilot was established between the University of Texas at Austin and Miami-Dade Community College. Although the volume of records exchanged in this pilot to date has not been great, it has established that records can be exchanged without significant losses of meaningful data and the crossing of networks is not a significant problem.

At about the same time, the task force learned of another project already under way in Arizona. The nine campuses of the Maricopa Community Colleges in the Phoenix area were sending student transcripts electronically in still another proprietary format to Arizona State University.

ANSI ASC X12 Approval

In April 1990, the two task forces (SPEEDE and the NCES PreK - 12) submitted a formal request to the ASC X12 committee to submit two new transaction sets. The first was the Student Educational Record (Transcript) and the second was the Student Educational Record (Transcript) Acknowledgment.

The approval process of ANSI is a slow and tedious one. It is based on the process of consensus.



At the ANSI ASC X12 meeting in February 1991 in San Francisco, the SPEEDE task force made a detailed presentation of the format of the student transcript and the acknowledgement transaction sets to the X12 sub-committee. Several suggestions were for change were made which were acted upon by the two groups (SPEEDE and NCES task forces).

An even more detailed presentation was made by representatives of both task forces at a meeting of an X12 Technical Advisory Sub-committee in April 1991. Further suggestions for changes were made by this group. After making most of these changes, the revised student transcript transaction set was presented to the X12 group again in June 1991. At this meeting, the student transcript was approved to be sent out to the entire X12 membership for a vote. It was also decided to hold off for a while on the acknowledgment record.

The X12 vote process requires that at least 97% of the votes cast be in total approval of the document. We only received 95% approval so we had to make some changes and send out a second ballot to all who voted the first time. As of February 7, 1992, that process is now complete. There were no disapproving votes on the second ballot and the student transcript is now an approved "Draft Standard for Trial Use". Approximately three years later it officially becomes an ANSI standard.

A big advantage in having the X12 final approval is that many EDI software vendors wait until that point before offering it with their product lines.

The acknowledgment transaction set, as well as two new ones, began the whole approval process in February 1992. The two new transaction sets that were submitted for approval in February are the "Request for Student Educational Record (Transcript)" and the "Response to Request for Student Educational Record (Transcript)."

Although none of the documents is an approved ANSI standard at this time, once our two task forces approved them, they are available for use by the educational community.

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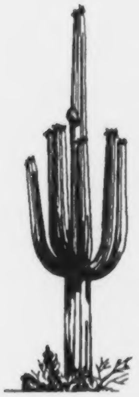
Our task force is also working with a task group in the finance area of the ASC X12 structure to develop an electronic guaranteed student loan certification transaction set.

SPEEDE Holds its First Implementation Workshop in Scottsdale, Arizona



The SPEEDE task force felt a need to get the project moving ahead and spur additional interest in other institutions. So the first draft of the *Implementation Guide* was prepared and distributed to the 100 attendees at an implementation workshop held in Scottsdale, Arizona in November 1990.

The workshop lasted for a day and a half and there was a great deal of interest in the project. Many institutions advised the group that they intended to get involved as soon as they returned to their campuses. Of course, there were also other priorities for computer programming support so very little programming was actually begun at that time. However, many institutions began to obtain support for the project on their campuses.

The workshop also gave the task force a chance to critique the *Implementation Guide*, the format of the workshop, and the direction the task force was taking.

Up to this point, the efforts of the task force concentrated on creating the *Implementation Guide*, agreeing on the data elements and code values, and creating the transaction set in the format that could be approved by the ANSI ASC X12.

One item that was discussed a great deal was the management of the project and the network options for actual exchanging the data. Although there was no consensus on these issues reached at the Scottsdale workshop, there was lively discussion on them.

First Implementation Guide Published

After making many changes to the first draft that was distributed at the Scottsdale workshop, AACRAO (with the financial assistance of the Law School Admissions Service) published the first official draft version of the *Implementation Guide* and mailed it to each institutional member of AACRAO in February 1991.

The *Implementation Guide* attempted to include everything an institution would required in the way of information to be able to send and receive student transcripts. It included a brief explanation of what Electronic Data Interchange (EDI) is, what are the benefits of EDI, what are the definitions used in EDI and in the student transcript, information on value added networks, and of course the format of the transaction set with many examples and most of the code sets that were required. Of course, the

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transaction set in the *Implementation Guide* published in February 1991 was not approved by ASC X12.

Two Task Forces Meet Jointly

In July 1991, for the first time, the two task forces (SPEEDE and the NCES group) met jointly in a meeting in Atlanta in conjunction with the Management Of Student Information Services (MOSIS) workshop sponsored by the Southern Association of Collegiate Registrars and Admissions Officers (SACRAO). At that meeting, the Pre-Kindergarten through Grade 12 NCES group officially adopted the name of EXchange of Permanent Records Electronically for Students and Schools (ExPRESS).

Second Implementation Workshop Held in Madison, Wisconsin

In October 1991, a second workshop was hosted by the University of Wisconsin at Madison. Attendance at this two-day workshop was about 150 (including over 40 from the various campuses of the University of Wisconsin). A revised and expanded *Implementation Guide* was distributed to all the attendees.

At this workshop, there was significant enthusiasm about the project. A report was given on the prototype project that had taken place between two of the campuses of the University of Wisconsin using the SPEEDE format. The University of Oklahoma announced that programming was complete and they were ready for pilot transmission using the SPEEDE format. A presentation was also made about still another format being used by the University of Maryland with Anne Arundel Community College to exchange student transcripts electronically. Several other schools indicated they hoped to begin programming as soon as they returned to their campuses.

An important announcement was also made by a corporate member of AACRAO about the project. Information Associates (IA) announced to the group that it was ready to market the SPEEDE format to its current customers. But in addition, IA had reached an agreement with BT North America (a value added network) to market stand-alone translation software utilizing the SPEEDE format. The formal announcement was made in December 1991 and beta-testing was to begin soon thereafter. IA hoped to have the product in production stage by April 1992.

NCES Awards Large Contract for PreK - Grade 12

One of the problems that the Pre-Kindergarten through Grade 12 group had from the start of their project was the lack of an association or organization that they considered could have management control and responsibility for their part of the project. There is no AACRAO for the public or private schools.

At the end of 1991, the Department of Education awarded a large multi-year multi-faceted contract to the Council of Chief State School Officers (CCSSO). One part of the multi-part award was to administer the ExPRESS project.

Where Do We Go From Here???

The most important problem in the EDI process (creating the national standard) was addressed first and we feel has been solved. Of course, this standard is a living document that will need to be modified as new institutions with different needs begin to use the standard. But we do have a national standard that is in the public domain that all institutions are free to use to facilitate the EDI process.

We are also in the process of gaining approval on three new transaction sets:

- Student Educational Record (Transcript) Acknowledgment
- Request for Student Educational Record (Transcript)
- Response to Request for Student Educational Record (Transcript)

In addition, we are cooperating with the folks at SallyMae in the approval of a transaction set for Student Enrollment Verification. This would be used by postsecondary institutions to respond with EDI to EDI requests to verify that a student who previously received a Guaranteed Student Loan is still enrolled at least half time.

We have discussed (with representatives from the Veterans Administration) a possibility of using EDI to certify enrollments to the VA.

Perhaps the greatest contribution that AACRAO can make to the project is to remove obstacles to the electronic exchange process as they occur.

We had discussed at length the use of one Value Added Network (VAN) that we would endorse as the preferred VAN. For security and reliability reasons, the committee has not endorsed the use of the public networks (Bitnet, Internet, etc.) for this project.

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However, several institutions who currently have access to Internet feel that the economics of that network make it the network of choice. And the reliability of Internet is expected to be better than that of Bitnet. At this point, the SPEEDE committee feels it would be inappropriate to endorse any one VAN although we continue to use the GEIS network for our pilot project under the auspices of and in cooperation with the Association of Higher Education of North Texas (AHE).

AACRAO is expected to continue to promote the SPEEDE project and to administer it for the postsecondary institutions by maintaining several code sets and data bases and by providing marketing and technical assistance support.

NCES, American College Testing (ACT), and Educational Testing Service (ETS) are pledged to work with SPEEDE to maintain a database and crosswalk of institutional codes that were begun by David Stones of the University of Texas at Austin.

We are asked frequently where we think the project will go from here. I guess I feel that within five years, we expect that 500 to 1,000 postsecondary institutions should have realized the tremendous benefits of SPEEDE and EDI and will be exchanging student transcripts electronically. Since the largest schools will likely be the first to participate, this will account for over 60% of the postsecondary student transcripts being exchanged in the US. In five years, these institutions will be receiving secondary records electronically from 30% of the high schools in the US, but these electronic transcripts will account for 50% of the total records received.

The exchange of student records electronically is clearly an idea whose time has come. It may be somewhat futuristic, but the future is now here.

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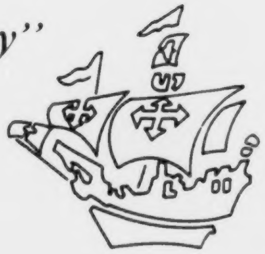

M3-4

Is Client/Server the Future of Information Processing?

Ruben Lopez
University of Miami

"IS CLIENT/SERVER THE FUTURE OF INFORMATION PROCESSING?"

INTRODUCTION

Client/Server computing is becoming an increasingly important topic to many of us who are viewing client/server computing as a way to meet the challenges of the 1990's.

The idea of integrating the varied resources within our institutions is extremely inviting. For instance, MIS departments with large and/or mid-range host systems can play an important role in client/server computing as servers and as managers of the client/server environment.

Several business and technology factors are becoming increasingly important in how institutions are choosing to solve business requirements. Each factor brings with it unique requirements that must be addressed. In most institutions today, we are seeing the need to rapidly respond to change in order to attract and retain faculty, researchers and students. Another element in an institution's ability to succeed is its use of information and information technology for competitive advantage. Information is now viewed as a strategic institutional asset. In today's corporate America, there is a trend toward streamlined organizational structures characterized by reduced layers of management. In order to make this strategy successful in higher education, there is the growing need to empower all levels of employees in information analysis and decision making.

Five years ago, the University of Miami embarked on a five year Long Range Information Systems Plan. One member of each applications development team was an empowered employee from the user area performing the function of information analyst. However, this information analyst viewed the new design functionality only from the principal user department perspective. Today, the applications development staff is incorporating departmental needs and requirements from all levels in the institution. This new approach provides departmental autonomy -- allowing for faster adaptation to change. This proactive process will give us an edge in the competitive global market.

Rapid change is also taking place in information technology -- providing institutions with new ways to respond to the trends taking place in the business environment. For instance, the power and capacity of workstations has dramatically increased -- allowing a much wider variety of instructional and research solutions by using an available platform that is easy to implement at a relatively low cost.

One needs to be aware of the potential problems of "islands of information" when employees are divided into workgroups. When a group of employees has formed into workgroups in order to share expertise and resources, it is the responsibility of the MIS department to be the catalyst to prevent the isolation process. Our responsibility in the client/server environment is to effectively share resources and expertise by using information technology.

CLIENT/SERVER AND DISTRIBUTED SYSTEMS

The client/server model of computing, as discussed in this paper, is relatively new. It traces its development from the original centralized computer architecture and the later development of tiered architecture.

The International Standards Organization has not established a standard definition for client/server computing. Client/server computing means different things to different people. It is very important to understand what people mean when discussing the client/server model. Information technology professionals are planning tomorrow's distributed computer networks based on their perceptions of this concept.

There is not very much consistency in the computer environment today regarding a definition of client/server. From a conceptual level, client/server computing is fairly straightforward. It is a distributed processing technology that defines:

- A client as a requester of service.
- A server as the provider of services requested by clients.

According to IBM's Art Olbert, Director of Client/Server Computing Client/Server is defined as the physical separation of applications and data between or among programmable systems. The Business Research Group has defined client/server computing as "a system in which application processing is shared between a desktop "client" and one or more network-attached "servers."[1] However, there are three critical elements to the function provided by a client/server system: cooperative applications; a support infrastructure; and seamless, transparent access to the applications and resources within the infrastructure.

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[1] "The Best in Client/Server Computing!," Datamation, 1 October 1991, p. 7.

The variable with the most influence on computing architectures will not be related to computer hardware or software, but to the experience of the end users. The dominant computing architecture, therefore, will be oriented toward maximizing the productivity and effectiveness of the end user. That evolving technology is the client/server.

The information technology professionals are obliged to examine elements thrusting the institutions solution toward the client/server technology. These elements are:

> "Technological: The power of today's desktop systems-coupled with advances in networking, relational database software and graphical user interfaces are enabling organizations to use personal computers and workstations for true corporate information processing.
>
> Economic: Information Systems managers are under pressure to lower costs even as they improve and increase the enterprise's information processing capability.
>
> Organizational: IS managers are charged with creating flexible systems that boost the productivity of revenue-generating and cost-saving employees. What do these organizations get for their efforts? Significant improvements in both end user and IS productivity. Information system consolidation. Better access to information technology, eventual decreases in operating costs. Improved control of corporate products and services."[2]

Advances in computer technology that lowered hardware prices allowed departures from the centralized architecture model to tiered architecture. The tiered architecture model utilizes departmental computers that shared central processor unit time and allows fewer users to share the resources than the central mainframe environment. Then came the personal computer--allowing a move away from the shared approach to computing. Personal computers did not, however, replace centralized and stand alone departmental computers.

Cooperative applications are the driving force behind any client/server implementation. A cooperative application involves distributing function and/or data across multiple systems. It can be viewed as a subset of distributed computing. The users have the opportunity to choose from a wide spectrum of applications designed to best exploit a particular business environment. Cooperative applications provide the key advantage of allowing customers to exploit the strengths of both programmable workstations and servers.

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[2] "The Best in Client/Server Computing," p. 2.

The traditional distributed computing systems were tightly coupled to a departmental minicomputer, supporting local discrete functions. Connectivity among these different computer types was minimal. However, all types of computers can coexist within an organization, although they may be isolated and operate independently. For the most part, the communications network was not on a "realtime" availability. One of the prevalent connectivity techniques was polling the appropriate queued files overnight. Local sovereignty over data and processing can make the system more responsive to local needs. It may also result in increased motivation and involvement of local personnel. However, this deprives the enterprise of the realtime data availability resources and expertise.

The term "distributed computing systems" described above should not be mistakenly confused with "distributed processing." "Distributed processing" is a general term that involves dispersing functions across two or more interconnected systems.

Client/Server Infrastructure

Users have many diverse computing requirements and these functions are sometimes best satisfied by a variety of different platforms. The client/server model utilizes existing resources in the enterprise such as the client, the network and the server.

Clients using workstations or high-end PCs will reach out to information on servers -- some of which is based on traditional minicomputers and mainframes. Users need workstation clients that provide access to a wide variety of applications critical to their business needs.

To maximize the user's efficiency, there must be a consistent, easy-to-use interface that allows the user to access applications and services with minimal training. Workstation clients must also be capable of being upgraded as system use and business requirements change -- thus protecting the investment that has been made in that system. The client must also be able to access services that are located on other systems in the institution.

As the use of intelligent workstations becomes even more widespread, our users are recognizing the need to integrate these workstations with all the other computing resources available in the institution or department. This integration has required two capabilities: an extensive network that reaches all of the resources in the enterprise and support of a multi-vendor environment.

To facilitate distributed computer network systems between dissimilar clients and servers, we need a strong communications system that supports multiple protocols and multiple vendor products. We also need to bridge between Local Area Networks (LAN) segments, Campus Area Networks (CAN), Metropolitan Area Networks

(MAN) and Wide Area Networks (WAN) whether they are on private loops or remote public networks. Client requests demand high speed communications capabilities to the workgroup or institution server. The networking capability of the workstation has also become very powerful. Ten years ago, communication and networking speeds were so slow that it was not productive to rely on remote systems for services such as file, database, and print sharing. The speed of data between devices directly attached to a networked server is faster with the implementation of fiber optic technology. Fiber and high speed T3 communications lines have allowed efficient networking between remote systems. Lastly, there must be a robust network technology in place to provide the function, availability, and management needed in such communications-intensive environments.

The selection of servers depends on the system size, geographical deployment, and type of application running on the distributed systems. The server investment needs to support the organization evolution in order to get full utility of the client/server components. The servers can be placed in two categories: the generalist and the specialist. The generalist server supports various workgroup sizes and can simultaneously act as a LAN server for installed personal computers and high-end workstations. The specialist server is dedicated to support specific functions such as peripheral sharing, applications software, gateway functions, file sharing, storage and retrieval, network and document management, batch processing, database systems, remote management and bulletin boards, just to mention a few.

The selection of mass storage for the server used to be easy. Traditionally, the preferred storage has been magnetic hard disk. In many ways, things are not much tougher today. One would probably still want a magnetic disk because optical disks remain slower and more expensive. The primary issue to consider is the controller interface, which defines how the controller and hard disk communicate. This interface is a significant factor in the performance of a single drive. If the network is small and the application requirements demand low volume of queries, then the interface issue is not as important. However, if one designs a large network with a high frequency of reads and writes, then the interface performance is critical on a single drive. Recent development in the server's drive addresses fault tolerance configurations in the form of disk mirroring and disk duplexing, as well as disk arrays.[3]

Earlier, we mentioned the consistent, easy-to-use interfaces that allow access to the institution's resources. This area lacks standardization. However, vendors use at least four methods to link network applications: Application Programming Interfaces (APIs), database servers, remote windows, and Remote Procedure Call (RPC) software.

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[3] Michael Hurwicz, "Selecting Server Storage," Lan Technology, August 1991, p. 45.

A network transport API is a vendor provided tool allowing applications programmers to access a proprietary client/server environment. Without an API, a programmer must be an expert in the LAN environment he or she wishes to access. A disadvantage is that a universal API model or definition does not exist. Consequently, APIs are not easily portable among different operating environments. The database server concept has erroneously become synonymous with client/server computing. In a database server network, an application server is dedicated to providing clients with distributed access to a database management system, usually employing the Structure Query Language (SQL) relational database model to communicate between client and server. Remote window systems are extensions of the "window" concept popular on PCs and workstations. The concept uses the Universal Terminal standard, ensuring multivendor connectivity. Remote processing calls are perhaps the most promising new technology supported under client/server computing. RPCs are based on Computer Automated Software Engineering (CASE) programming tools -- allowing conventional procedure calls to be extended across a network. An RPC allows application programmers to develop applications for single or multiple environments without understanding the underlying network operating systems and communications protocols, which are handled by the RPC.

CLIENT/SERVER DESIGN CONSIDERATIONS

In order to share resources, the client/server systems fall under the category of "loosely coupled systems." Loosely coupled systems give the impression that they are using a single, integrated computing facility, although the facility is actually provided by more than one computer and the computers may be in different locations. The shared resources needed are made available by some of the computers in the network and the access is supported by system software that runs in all of the computers using the network to coordinate their work and to transfer data between them.[4]

One goal of client/server computing is interoperability by mixing, matching, and linking applications with different components across networked environments. Linking people with applications requires more than simply connecting hardware (connectivity). Today's users search for ways to connect applications from different vendors (multivendor interoperability).

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[4] George F. Coulouris and Jean Dollimore, An Introduction to Distributed Systems: Concepts and Designs (New York: Addison-Wesley (1988), pp. 1-20.

The main design goal is to create the effect of distribution transparent to the user. Users should have a view of the system as whole and normally need not even be aware of the locations of hardware and software components from which the system is constructed. In addition, the system should execute tasks for its users consistently and effectively. Location transparency refers to several aspects of design of a client/server system. In this discussion, we are concerned with location transparency because it is the form of transparency that is most strongly affected by architecture of the system. There are three levels of location transparency.

> Level 0. At this level the user sees separate computer systems that are able to communicate in specific ways. Usually there are facilities for remote login, file transfer and remote execution of programs. More specific protocols are defined in the application programs for the above facilities; these protocols are widely used and are either actual international standards[5] or regarded as de facto standards.
>
> Level 1. At this level there are some application programs that conceal the multicomputer environment. When using these applications, users are not aware that more than one computer may be cooperating to provide the service they use. The applications are constructed as fully distributed systems with server processes providing location-independent access to specific shared data and client processes interacting with users and accessing the shared data on their behalf.
>
> Level 2. At this level the servers provide general-purpose, network-wide services to share data and hardware resources -- concealing the multicomputer environment from application programs. Application programs can be constructed without any need to take into account the location of the shared data resources.

WHY CLIENT/SERVER COMPUTING?

Client/Server computing will help organizations to better match technology to their institutional goals. The challenges of a global economy require that information systems be redeployed quickly. The sharing efforts between researchers, co-authors, administrative academic support units, and long distance education require realignment of MIS resources to support and integrate new data processing operations with those of the institution. The more fluid design of client/server computing, which isolates the application from the information it processes, will enable institutions to restructure and access information on new servers with only minor programming changes.

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[5] CCCITT 1981. Character Terminal Access To Public Packet Switched Data Networks-X.3, X.28, X.29, International Telecommunications Union, Place des Nations, 1211 Geneva, Switzerland.

Let's analyze some of the issues currently facing our organizations:

Accessing information residing on standalone PCs and distributed departmental computer outside the central facility.	Client/Server solution - Applications on PCs will be able to access data at multiple locations using high speed networks and servers.
Corralling "maverick" end-users who are introducing new technologies outside University guidelines.	Client/Server solution - Client/Server will allow for more flexible guidelines. It will also make it easier for emerging technologies to be linked to old programs.
Enticing employees to use computers and minimize training costs as users switch systems.	Client/Server solution - Institutions will be able to standardize on one interface at the client. This will eliminate retraining.
Securing data outside the host.	Client/Server solution - With Client/Server, programs can be distributed to the desktop while data can be put on an MIS-secured server for audit and control purposes.
Protecting the investment in personal computers.	Client/Server solution - PCs are now the platform for all applications. As the usage becomes even more widespread, our users will recognize the need to integrate these PCs with all the other computer resources.

At the other end of the spectrum, there is the fully transparent distributed form where many processors are either executing specific parts of application code or supplying data. A fully transparent cooperative application allows this interaction to take place without any special considerations or actions on the part of the end user. This design provides the advantages of being able to implement business-critical applications that may rely on many different computer systems across an organization. Data and application codes can be placed on the processor that makes the most business sense and, at the same time, can be exploited in the implementation of other business solutions. All of these technological advancements have allowed the client/server to take on new roles. As a client, the Client/Server has become a flexible platform for business applications. As a server, its strong networking capabilities allow it to provide resources sharing within the workgroup and the organization.

CONCLUSION

Client/Server will require the close coordination of several technologies -- from the network level to the applications level. The critical question dealing with limitations inherent in industry standards needs immediate attention. What standards are in store for the future? To become widely accepted, client/server systems require a standard RPC, a standard network protocol stack, and standards for the way applications communicate.

There is a new message-passing technique offering more efficient use of distributed resources than RPC technology. Although not yet popular as client/server, the peer-to-peer model may be the future of distributed networked systems.

For many of us the mission is critical. Users are looking for three things from the client/server. Aggressive price/performance in the PCs, servers and workstations; the ability to deploy more functionality; speedy applications development cycles. Client/Server will facilitate the users with local processing power enabling them to perform interactive tasks more effectively than in a timesharing system. This technology provides great responsiveness to users, extensibility, the ability to share information and resources and continued availability. The main drawbacks are related to lack of industry standards and the potential failure of a single component within a system that is still running; these can produce new sorts of error modes. Barring any new tremors, the computer industry is ready to support a transition of this magnitude by having architecture that can handle processing large blocks of data and move them through the network.

The client/server model attempts to address the desire for freedom and ease-of-use of a single user system -- combined with the performance and control of traditional host-based, multi-user computing. Early adopters are discovering that it is complex to implement, but when you do it's cheaper. In some cases users are finding that it's half as expensive as a minicomputer and a third the expense of a mainframe computing. The growth in the network will put additional strain on the users ability to manage the network resources. This is an opportunity to introduce a new unit of measurement called "number of input/outputs per sec" (NIPS). This term is described as the ability to move large blocks of information quickly through a network, as opposed to "millions of instructions per second" (MIPS), which essentially measures the power of an individual machine. Client/Server has the ability, when implemented correctly, to utilize embedded telecommunications infrastructures cost-effectively. This is clearly an evolutionary step. The ability to provide interoperability between and among systems often is complex because the integration calls for different and incompatible hardware and software. This technology will allow us to develop and deploy business and instructional critical applications which may have data and resource requirements from across the institution.

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M3-5

Let's Define Distributed Computing: Provocative Paradigms

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Let's Define Distributed Computing: Provocative Paradigms

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The phone rings at the Information Center in the Registrar's Office at The University of CUMREC/Belle Fourche and a trained help desk consultant walks a user through the CSSF LOGOFF transaction. Moments later, a student caller is coached on accessing the UniNet Grades Display Server and Degree Progress Review System. Across campus an associate dean of students has just downloaded a file of data on student inquiries, applicants, admits, and enrollees, for the past four autumn terms. She then accesses the financial aid files for the relevant financial aid data for these same students and begins developing a series of NEXT models to forecast tuition and financial aid outcomes for the coming term. This same busy morning, the facilities director finalizes the acquisition negotiations with IBM for an AS 400 to run a new space planning, project management and classroom scheduling system their office recently purchased. This describes a typical day at CUMREC University/Belle Fourche.

What do we mean when we ever so loosely use the terms "distributed computing?" Can we point to fundamental assumptions about our notions of what constitutes distributed computing today? Do we in fact share an understanding of what it should be, of its directions and possibilities? I believe that we in fact do need to push for sharper definition and clarity in our discussions of "distributed computing" and what follows proposes to do just this. After a brief review of various assumptions that might be in common to most conceptions of end-user computing, I put forward an argument for a definition and paradigm of distributed computing that extends these generally accepted models. What follows is intended to provoke reflection, response and debate, though it is by no means a straw argument, rather an actual organization operating today at Columbia University in the City of New York.

For a backdrop, please consider your answers to the following set of questions, keeping track of your responses as you review the questions:

- Would you describe yourself a "user" of information systems technology?
- Are you "provider" of that technology?
- If you are a "provider," would you characterize your position your institution as "central" in the institutional organizational model?
- Do you work in a "functional unit"?
- Are you "decentralized" or "distributed"?
- Are you an "end user"?
- Do you work in a "client/server" environment?

These and other apparently simple questions and their responses do get to the basic issues that I believe ground our thoughts on distributed computing. My argument is part definitional, proposing agreement on key attributes defining distributed computing, and part propositional, suggesting that in fact our technology has demanded organizational change in higher education information management structures and we have not in the main responded adequately to the opportunities afforded by this very technology. I argue that armed with a precise definition of distributed computing, we can and must consider radically different organizational models and paradigms to manage the most critical institutional resource, information. To begin, then, I would ask you to pause for a moment or two and write down your answer to the following question: how would you define "distributed computing"? What do you mean when you use the phrase and what generally do you think others mean when they refer to this mode of information processing? Please do take a moment to jot down your notes now, and as I present my thoughts, it may prove useful to measure them against your thoughts on distributed computing.

I would define "distributed" computing as follows:

The strategic allocation of information systems resources and their management to the primary provider of the application services supported, with the concomitant responsibility, accountability, and authority for their successful utilization.

In much less formal terms - the user office responsible for the functional operational services is also ultimately responsible for the computing resources applied to the support and delivery of those functions and services. Before I describe what I think to be an optimal organizational paradigm to fit this definition, I think it will be valuable to take a step back and consider the environment and technological context that I believe demands new organizational structures in order to strategically respond to the opportunities afforded by this technology.

The single most important aspect of our emerging technological infrastructure and architecture lies squarely in the client/server model of information systems. I would refer you to the Spring, '91 issue of CAUSE/EFFECT for an excellent discussion of the changes heralded by Client/Server architecture. Quoting Freeman and York, "Client/server computing is as important to the 1990's as the time-sharing model was to the 1980's. It will initially cause confusion but will ultimately lead to systems that are highly functional, easy to use, and affordable. The technology to implement effective client/server systems is now emerging, but key standards, tools, and skills necessary to construct them are only nominally available. Hence the transition to this new environment will not take place overnight; rather it will emerge gradually in the coming decade." I would emphatically add that the organizational response to client/server architecture will be the ultimate determinant of the success of this architecture to meet the institutional goals and objectives sought.

The confusion that Freeman and York suggest will find us may already have done so, directly in our response to the technology in varied distributed computing models attempted. For what we've discussed for a decade as "distributed computing" and increasingly over the past years since the introduction of the pc and the subsequent advances in local area network technology and pc based application systems, this is already here and already causing significant confusion and distraction.

Perhaps William Butler Yeats was not referring to our campus computing political scene when he wrote "The Second Coming" in 1920, but I bet he wouldn't mind my quoting some of this poem here:

The Second Coming

Turning and turning in the widening gyre,
The falcon cannot hear the falconer;
Things fall apart; the center cannot hold;

Mere anarchy is loosed upon the world,
The blood-dimmed tide is loosed, and everywhere
The ceremony of innocence is drowned;
The best lack all conviction, while the worst
Are full of passionate intensity.

"The center cannot hold" -- I think that the fact of the matter today is that indeed "the computing center" as many of us know it, cannot hold -- that the falcons out in the user area cannot in fact hear the MIS directors and managers, that things fall apart and we see anarchy of information technology.... I'll let the literary argument rest, grateful for your indulgence.

In most reduced terms what I am suggesting is that things are in varying states of confusion on many of our campuses, organizationally. This is in great part due to the rapid and all but uncontrolled emergence and proliferation of the pc, mini-computer, and network capabilities in the user offices and across our campuses. Our management and organizational response to this technological revolution has lacked coherence, strategic direction, and vision. It is an imperative to us now that we do in fact exercise the same level of excellence and leadership that enabled this technological breakthrough as we engineer our organizational breakthrough.

To move towards my definition of distributed computing and a model that attempts to reflect the principles inherent in the definition, I will suggest what I think distributed computing is not. Distributed computing is not an information center run out of a user office, providing ad hoc reporting support, help desk responses to terminal users, and training sessions on application systems. It is not creative network solutions in user offices that provide in-house stand alone systems which might interface with host-based productions system. Distributed computing most certainly is not staff reporting centrally but working out of the user office. What is it? I believe the a functional distributed computing model needs to distribute responsibility, accountability, and authority for information resource management. Our experience at Columbia provides a case study for consideration.

The senior management of the university decided to move the responsibility for a new student information system project directly to the user area. Creating a division called Student Financial and Information Services, SFIS, the university united in one division the Bursar's Office, the Registrar's office, the central Student Financial Services office, the Career Services office, and the Student Information Systems group. Both the functional operations and the systems that support them report to the same deputy vice president. Without getting into a detailed review of the various functional operations within the division, it should support my argument to briefly describe the range of responsibilities that falls to the SIS group:

Our SIS Director has many years of data processing experience behind her, from university and corporate environments, and she has full responsibility for our SIS project: from vendor selection, negotiation and contract management, to project budget management, to the project calendar and delivery schedule, to staff hiring and oversight, and to user coordination, the SIS project responsibility lies fully with this office. We have distributed the management of the SIS project to the user office, the functional area responsible for the operations supported by the systems.

You might be wondering what the central Administrative Information Services (AIS) group does at Columbia. AIS is in fact a partner in this project, and they provide what one might call the infrastructure for the information systems environment. From the actual machine services, systems maintenance, data communications, network services, and advanced systems planning and support, AIS is the backbone of computing at the university. Some of their applications support staff are loaned to our SIS project, reporting to the SIS Director for the duration of the three year effort; they work in our office with the dozen or so in-house programmers, jointly implementing the new SIS. We are indeed partners in this project, with final responsibility for success in the hands of "the primary provider of the application services involved."

It is important, I believe, to note that our SIS Director moved to a "user" office from a dp shop -- I believe that we will in fact see more and more of this migration, and I believe that we must see this distribution at the most senior levels of the organization. In my position, I have full operational responsibility for the activities of the Registrar's office, the Bursar's office, the Career Services Center, and Financial Services -- and I am fully responsible for the SIS project success, or failure. I am held accountable for its success - no blaming the computing center for delays and misunderstanding of functional specifications; the buck stops in my office, not across campus at the data center. Importantly, with this responsibility, we have the authority to make decisions, to shape the project, and to determine strategic and tactical directions, aligned with the operational and functional imperatives of the user offices involved. My staff meetings bring users and providers of information systems together, and issues of priorities, project deliverables, resource allocation, and more, are discussed under one management group process, not across divisional or office boundaries.

I have made a point here to argue definitions, from responsibility to accountability, and in this vein, let me expand briefly on the meaning of authority, as I use it here. I suggest that when we think of the word "authority" we consider the more subtle aspect underscored in the phrase "one speaks with authority" -- that's a critical aspect to successful distributed computing - the expertise and professional experience must ground the effort and be moved to the distributed leadership of application systems delivery and support. The individuals responsible for the SIS must have authority and speak with authority.

The key to the success of the distributed computing model will lie, I contend, in the alignment of strategic objectives between the operational unit and the management of the information resources allocated to the unit. Priorities can be discussed amongst the managers of the functional unit, and decisions about implementation and systems development criteria can be made in a context rich with business planning and management objectives. The real "stake holders" will be involved in the critical decisions.

What about other definitions of "distributed computing," other organizational paradigms that compete with the model presented here? A brief review of some of the more common approaches is intended not to simply dismiss them, but to hold them against this approach to evaluate their strengths and weaknesses that might appear.

Within the past year, I have had occasion at two professional conferences to ask the questions I have asked in this paper, asking higher education computing professionals to define distributed computing. The common factor most often found in their responses has dealt not with distributing the professional expertise, but with distributing data! End-user access to their data has been a common definitional ground. Distributed data in the hands of talented "users" with powerful 4th generation query languages and report writers is often the definition offered. While of course we do indeed seek to provide such important access, I feel this misses the point - distributing data is not distributing computing. Nor is the distribution of computing cycles to desktop workstations truly distributed computing. Certainly something is distributed, but not the direction, leadership, the destiny of computing resource management, in such a model. In my opinion, and experience, what often has happened with such distribution is the emergence of what I've called "disintegrated computing". Systems are often built on local networks, shadow systems solving local operational problems, but often lacking coherence with other administrative systems and data bases.

Some have suggested that distributed computing is reflected in the emergence of the "information center" approach to getting information out to the users. Again, while I believe strongly in the information center approach, I do not think this provides us with a useful model for distributing computing. It often does provide help lines, and a very valuable resource to aid in the implementation of systems and their optimal utilization, but it begs the issue of information resource management and control by the end user offices.

While these do not meet my expectations for distributed computing I have been compelled to acknowledge the constraints facing many institutions that might not be able to distribute computing in the manner suggested above. The Director of a computing center in a small school in Virginia simply asked me how I might suggest she distribute her three professional staff members to the campus! Indeed, I had no answer to her very real concern -- does this approach only work in large institutions with the resources to acquire the talent and expertise to distribute as we have at Columbia? Perhaps so, but I believe that there are some fundamental points made here that might inform all computing management decisions. Even small schools report the emergence of personal computers in user offices, the development of "shadow systems" that compete with central application systems for solving user problems while central staff are backlogged with institution-wide requests for support and service.

We all must acknowledge the development of our technology and its inevitable emergence in user offices. We must consider the level of expertise in these offices, and the degree to which there will be fragmentation or unity in our management of these institutional resources. Issues of responsible managment, accountable service, and authority for decision making, must be considered to approach a campus computing vision and shared direction and integrated solution to information resource management. Small and large, each of our campus environments faces similar problems and each must articulate a plan for the distribution and strategic direction of computing technology.

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M4-1

Building a New Admission Recruitment System Using an Integrated Approach for Data Management

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Building A New Admission Recruitment System Using An Integrated Approach for Data Management

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1. INTRODUCTION

Boston College was founded in 1863, and is one of twenty-eight Jesuit Colleges and Universities in the United States. The student enrollment at nine schools and colleges includes 8500 full time and 6500 part time and graduate students. The Administrative Information System supported by Management Information System runs on an IBM 3090 with MVS/XA 2.2 operating system.

The Admission office deals with every facet of university life. The office is comprised of professional, support, clerical, and student staff members. Alumni and faculty are also actively involved in the admission process. As the university has matured, the Admission staff has grown to include 14 professional staff, 8 support staff, and 9 clerical staff members. Of course, the number of volunteers has also grown to include more than 50 faculty, 400 students and 2000 alumni. Coordinating, focusing and evaluating the efforts of this diverse group has become a very complex task.

This paper will discuss:
- (a) the process that noted the needs of the Admission Office;
- (b) the goals and objectives of this project;
- (c) the strategy to develop a new system;
- (d) how the Admission Recruitment System works; and
- (e) issues raised during system implementation.

2. PROJECT BACKGROUND

2.1 History

The Admission system was originally developed and implemented on an IBM mainframe in 1977. The old system automated a manual process that simply responded to requests for information and applications. This system had two principle files, one for prospects and inquiries, and one for applicants. These files were not integrated and were maintained by different members of the Admission Staff. This dichotomy inhibited Admission's effort to track the success of various recruitment efforts since there was no comparison of the names on the prospect/inquiry file with those on the applicant file.

Since the original Admission system was implemented, Boston College has grown from a regional university to a truly national university. Even now Boston College is developing into an international university. During this period, the number of freshmen inquiries has increased from 35,000 in 1981 to 50,000 in 1991. Meanwhile the number of freshmen applications has decreased slightly from 12,700 in 1981 to 11,500 in 1991. While Boston College typically needs to enroll only 2,000 freshmen from this large pool, the Admission and Enrollment Management offices were concerned about the nationwide statistics that indicated a shrinking applicant pool. For this reason, the Enrollment Management office wanted to attract more inquiries to maintain or increase the applicant pool at Boston College. The need to recruit more inquiries grew even more crucial as the recession set in across the nation during the past year.

The old system only permitted the collection of name and address information. It only produced limited statistics for the evaluation of recruitment efforts. The lack of a complete database inhibited the recruitment efforts of the Admission office which coordinated all recruiting events and activities. For example, the old system did not record the phone number of prospective students that requested admission information. However, the phone number was needed for the annual recruitment telethon. To gather this data the Enrollment Management and Admission offices had to ask MIS to down-load the names and addresses of inquiries onto a magnetic tape. They then sent this tape to a vendor which matched the names and addresses with telephone numbers at a cost of more than $10,000. This one limitation in the recruitment system cost valuable time and money!

2.2 Project Prioritizing

Within the University hierarchy , the Admission Office reports to the Dean of Enrollment Management who also oversees the operation of Enrollment Management Research, Financial Aid, and the University Registrar. These offices comprise the principal administrative support within the Academic Vice President area.

As BC entered the "Most Competitive" ranks of private higher education institutions it became more critical to design a comprehensive data base to handle the large volume of prospects and inquiries in a personalized manner. In order to enhance the admission process the Dean of Enrollment Management and the Director of MIS gave the admission recruitment project top priority during the summer of 1989.

2.3 Identifying Recruitment Tracking Needs

While discussing database needs the desirability of tracking all recruitment activities emerged. Early discussions indicated that the purpose of most events is purely expositional, that is, to get the name of the university in front of the prospective student. While an event may spark some interest it is unlikely that a single contact will carry a prospect into the halls of higher education. The Admission office was very conscious of the need to ensure that a prospective student had access to BC students, faculty, staff and alumni. Such access is natural and desirable in university admission to make certain that the prospective student will make an informed choice to attend or not attend the university. To optimize the prospective student's access, the Admission office needed a way to match a prospective student's interests with likely contacts associated with the University.

The Admission office also wanted to know what ideas or contacts helped the prospective student make a decision (yes or no) about attending Boston College. To do so required the ability to track mailings, phone calls, interviews, tours, alumni interviews, etc. This tracking would also permit yield analysis of the various recruitment efforts and assist the refinement of the recruitment and marketing strategy. Concurrent with the MIS effort, the Dean of Enrollment Management sought to increase the involvement of academic departments and BC alumni in the recruitment of the best students on regional and national levels.

3. GOALS AND OBJECTIVES

The goals for the implementation of a new Admission Recruitment system were 1) to enhance the admission recruiting process by building a larger and stronger applicant pool with higher academic quality for the undergraduate population; and 2) to provide more responsive personal contact for prospects, inquiries, and applicants. The primary objectives can be summarized as follows:

A. To expand the data available about each prospective student;
B. To integrate the admission files in order to eliminate duplicate keying of information; and decrease erroneous information;
C. To track all recruitment events and activities;
D. To develop management reports to support enrollment planning and assist with the analysis of recruitment efforts; and
E. To provide universal connectivity within the Admission Office by bringing new technology to their desk tops.

4. DEVELOPMENT STRATEGY

4.1 Planning for a New Administrative Information System

Following the discussions that established the goals and objectives for the new recruitment system, a project team was formed in the Fall of 1989. This team included several users from the Admission office and several members of the MIS staff. Unifying the efforts of all the players in the admission process became the core of the project plan. The discussion quickly moved from a feasibility study which might have resulted in pc based solutions to the analysis and documentation of a system that would be installed on the university mainframe. Administrative Information System users in the Registrar, Financial Aid and Academic Deans Office were consulted as the plan progressed.

The implementation plan was divided into two phases because the project had two principal components. The first phase concerned the integration of the Admission files and the expansion of the data available. The second phase concerned the creation of new files to track events and mailings throughout the recruitment process.

The plan for PHASE I included the expansion of Prospect/Inquiry records from 200 bytes to 1300 bytes. New data included test scores, academic interests, extra-curricular interests, parent data and additional biographical detail such as phone number. To initialize this data the system was designed to process several vendor tapes such as College Search, SAT/Achievement Test scores, and ACT scores. Several CICS transactions were also designed to allow the Admission office to maintain the data base. Lastly, the plan specified that this augmented file would function as an extension of the existing applicant file. By interrelating the Prospect/Inquiry file with the Applicant file the PHASE I plan centralized data management for prospects, inquiries, and applicants. This eliminated data duplication and simplified data entry. One useful design feature identified in PHASE I was a new scrolling display screen to list all available information about the prospective student that would assist staff members to handle telephone calls and conduct interviews.

Meanwhile the plan for PHASE II concerned recruitment activity tracking. One of the principal objectives of the new recruitment system was the evaluation of the success of individual events and mailings in attracting students to the university. While this goal seems simplistic it belies the unquantitative nature of college admissions. An Activity Control File was planned to identify events and mailings. An Activity Detail File was designed to record which mailings were sent to individuals and the event attendance of prospects, inquiries, and applicants. The PHASE II plan detailed all recruitment efforts by individual and by the type of event and mailing. It must be noted that all planning for these system improvements took place within the structure of the Administrative Information System at BC. For example, the Admission files interface with the Financial Aid, Housing, and Student files. Furthermore, plans for the new recruitment system relied upon the existing mainframe letter processing system to handle the high volume production of customized letters. All of these systems reside on the University's IBM 3090 and share a common user interface in a single CICS environment. In this way, the Admission system was fully integrated with other administrative systems supported by MIS.

The development strategy was also simplified by assuming all existing MIS standards. Various internally-developed generic system utilities and callable functions available to all administrative systems helped facilitate the Admission system development. These include such utilities as an on-line table building facility, on-line help via PF1 key from any transaction, and on-line code lookup.

4.2 Planning for Total Office Automation

In addition to the software development for the Admission Recruitment System, the utilization of technology was explored to enhance the access and maintenance of the new data base. MIS coordinated a comprehensive needs analysis for Admission workstations with other Information Technology departments. A sub-committee to articulate and implement the workstation plan for Admission was formed in September 1990. The short term plan focused on mainframe connectivity issues and providing the proper workstation for each staff member, while the long term plan considered the use of local area networking.

4.3 Concurrent Efforts To Enhance the Admission Recruitment Process

The Admission office took a leadership role in coordinating the recruiting efforts with various academic departments and alumni volunteers. The Admission office envisioned the standardization of all procedures for information handling related to undergraduate admission. Staff of the Incoming Freshman Financial Aid office were invited to join the discussion during the system development and design to insure that the admission process would remain coordinated with the financial aid awarding process.

5. HOW THE ADMISSION RECRUITMENT SYSTEM WORKS

5.1 System Review

The Admission office has divided the recruitment process into various stages. Each stage is marked by a milestone event which indicates that the status of a prospective student has changed. The stages mark the steps that lead a prospective student to becoming a BC student. The principal stages with definitions are listed below.

STAGE	DEFINITION
a. Prospect	A person who has not contacted the university that might be interested in going to Boston College based on information supplied by various vendors, such as the Educational Testing Service.

b. Inquiry	A person that has contacted the University for Admission information.
c. Applicant	A person who has applied to the university.
d. Completed Applicant	A person who has submitted all required application forms and a decision on the application is pending.
e. Decision On File	A person's application was reviewed and evaluated by the Admission Office and an admission decision (accept, wait list, denied) has been determined and processed.
f. Deposited	A person who was accepted and who has sent in the required deposit to matriculate.
g. Student	A person who has registered for classes and paid their bill for the first semester.

As this list implies, the Admission Office is involved with the prospective student from their appearance on college search tapes through their actual attendance of classes in the fall of the freshman year. Identifying the most likely students and encouraging them along is one of the many challenges that face the Admission office.

All admission data about potential students is spread among five inter-related VSAM files. These files are the:

- Prospect/Inquiry File,
- Applicant File,
- Applicant Forms Tracking File,
- Activity Control File for Events and Mailings,
- Activity Detail File for Events and Mailings, and
- High School/College file

While these files are physically distinct they are linked by common primary keys and alternate indices. In this way the files tend to act as a single database. Records are created on these files as necessary. For example, the first file that would receive data about a prospective student would be the Prospect/Inquiry File. This file contains biographical information, demographic data, personal interests, and address data in 1300 bytes. The Prospect/Inquiry record lays the foundation upon which the entire recruitment system depends for information about this individual.

The inter-relationships of these files during various stages in the recruitment process are illustrated in FIGURE 1. The files displayed in Figure 1 are used by various sub-systems. Each sub-system reflects a distinct function within the Admission Office. The major portions of the recruitment system are:

1) the maintenance of prospect, inquiry & applicant data,
2) event management and tracking and
3) mailing management and tracking.

ADMISSION RECRUITMENT SYSTEM

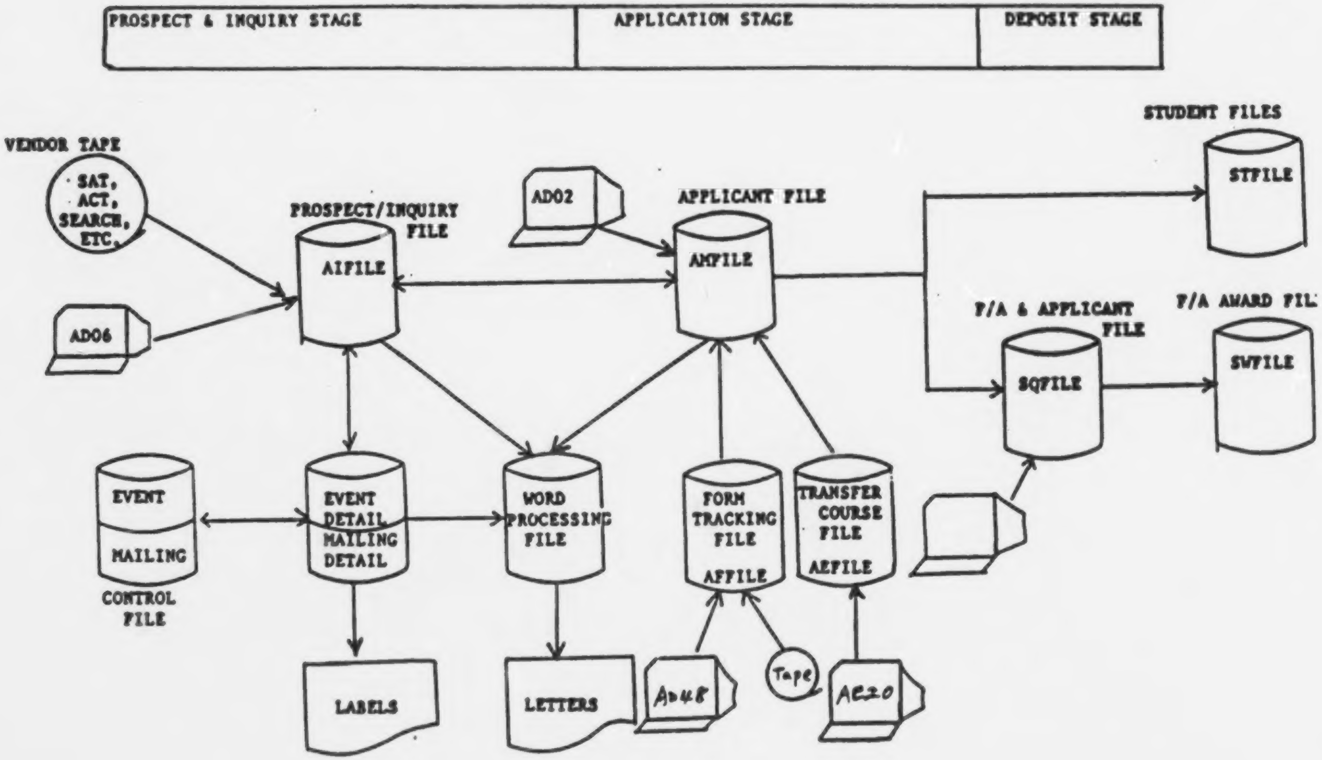

PROSPECT & INQUIRY STAGE
APPLICATION STAGE
DEPOSIT STAGE
VENDOR TAPE
SAT, ACT, SEARCH, ETC.
AD06
PROSPECT/INQUIRY FILE
AIFILE
AD02
APPLICANT FILE
AMFILE
STUDENT FILES
STFILE
F/A & APPLICANT FILE
SQFILE
F/A AWARD FIL
SWFILE
EVENT
MAILING
CONTROL FILE
EVENT DETAIL MAILING DETAIL
WORD PROCESSING FILE
FORM TRACKING FILE
AFFILE
TRANSFER COURSE FILE
AEFILE
LABELS
LETTERS
AD48
Tape
AE20

FIGURE 1

5.2 Processing Information for Prospect, Inquiry, and Applicant

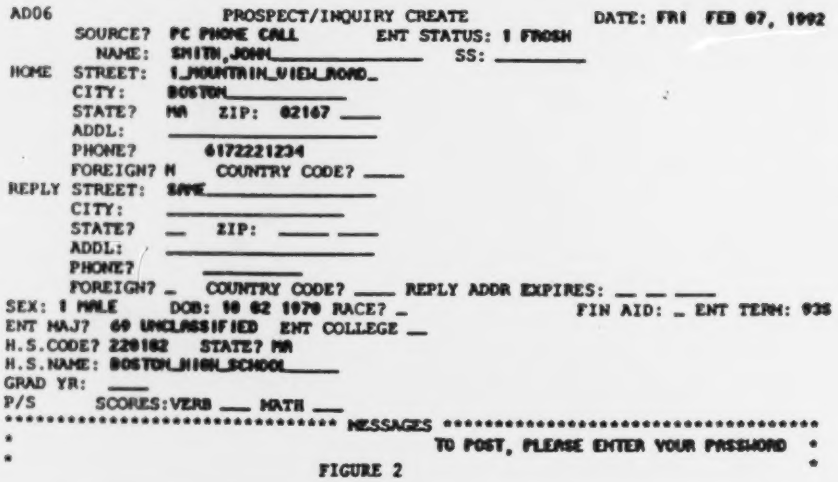
There are several ways to add records to the Prospect/Inquiry file. The most common way is through the addition of names from vendor tapes. These tapes vary in the amount of information supplied, but all contain name, address and potential entrance term. The names of students that call, write or walk into the office are added through an on-line transaction called AD06 - Create Prospect/Inquiry. A sample display of this transaction is shown in FIGURE 2.

Handling duplicates can be a problem when loading information from many sources. To handle this problem the new system allows duplicate records to be merged or deleted. Logic was built into the programs that load vendor tapes to not add the possible duplicates and to print a listing of them. Meanwhile, the on-line screen that creates prospect and inquiry records searches the file for possible duplicates before permitting the user to enter all the data for a new record. Only after the user has reviewed the possible duplicates can the rest of the information be entered and a record created. This saves time by reducing keystrokes and duplicate data that needs to be deleted later. In any event, there will always be some duplication. For this reason a batch job was written to be run weekly to identify potential duplicates which can be resolved by the Admission staff manually.

All of the new on-line transactions include a set of built in features that make them much easier to use than the original system. As a result of these helpful features and other MIS standards, the recruitment system on-line transactions have consistent appearance and functionality. The helpful features that are built into the new system include:

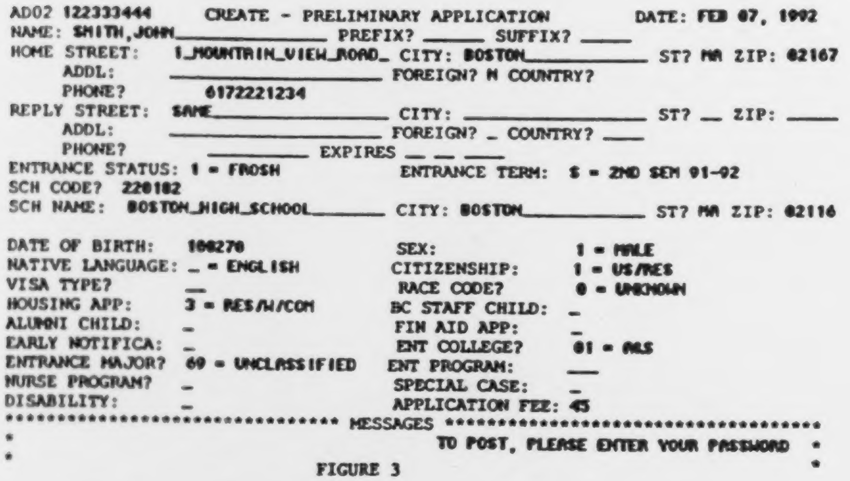
- on-line documentation that explains how the transaction works;
- on-line edits that prevent the user from entering invalid data;
- on-line warning messages that identify potential mistakes;
- underlines that appear in all input fields to make them more visible, especially on monochrome monitors; and
- built in transaction security that limits access to all parts of the system, especially create and update transactions.

One of the most popular features of the new on-line screen is the question mark lookup facility that truly exploits the concept of an integrated system. The question mark lookup option allows terminal operators to look up codes that are stored in files or on-line tables. Any field that has a "?" next to its title will allow the user to enter a "?" in the field. When the user hits "ENTER" the screen will be saved and another screen with all the valid values for that field will be displayed. For example, if the user enters a ? in the "STATE?" field on AD06 then the on-line screen called MS45 - Browse Table Occurrences



```
AD06                PROSPECT/INQUIRY CREATE           DATE: FRI  FEB 07, 1992
      SOURCE?  PC PHONE CALL       ENT STATUS: 1 FROSH
        NAME:  SMITH,JOHN_______________   SS: _________
HOME  STREET:  1_MOUNTAIN_VIEW_ROAD_
      CITY:    BOSTON__________
      STATE?   MA   ZIP:  02167 ____
      ADDL:    ____________________
      PHONE?       6172221234
      FOREIGN? N    COUNTRY CODE? ____
REPLY STREET:  SAME________________
      CITY:    __________________
      STATE?   _    ZIP:  _____ ____
      ADDL:    ____________________
      PHONE?       __________
      FOREIGN? _   COUNTRY CODE? ____ REPLY ADDR EXPIRES: __ __ ____
SEX: 1 MALE      DOB: 10 02 1970 RACE? _                FIN AID: _ ENT TERM: 935
ENT MAJ?  69 UNCLASSIFIED  ENT COLLEGE __
H.S.CODE? 220102   STATE? MA
H.S.NAME: BOSTON_HIGH_SCHOOL_____
GRAD YR:  ____
P/S       SCORES:VERB ___ MATH ___
******************************** MESSAGES ***********************************
*                                     TO POST, PLEASE ENTER YOUR PASSWORD  *
*                                                                          *
```

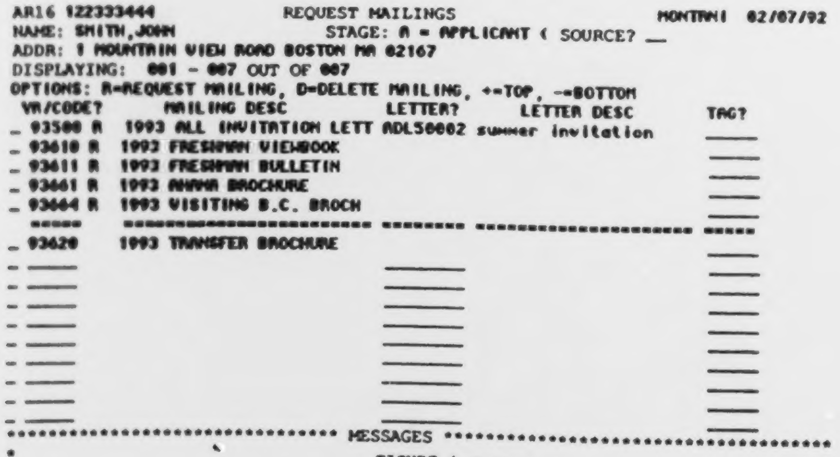
FIGURE 2



```
AD02 122333444     CREATE - PRELIMINARY APPLICATION       DATE: FEB 07, 1992
NAME: SMITH,JOHN_______________ PREFIX? ______ SUFFIX? _____
HOME STREET:    1_MOUNTAIN_VIEW_ROAD_ CITY: BOSTON____________ ST? MA ZIP: 02167
     ADDL:      _____________________ FOREIGN? N COUNTRY?
     PHONE?         6172221234
REPLY STREET:   SAME_________________ CITY: __________________ ST? __ ZIP: _____
     ADDL:      _____________________ FOREIGN? _ COUNTRY? ____
     PHONE?         __________ EXPIRES __ __ ____
ENTRANCE STATUS: 1 = FROSH            ENTRANCE TERM:  5 = 2ND SEM 91-92
SCH CODE?  220102
SCH NAME:  BOSTON_HIGH_SCHOOL_______ CITY: BOSTON____________ ST? MA ZIP: 02116

DATE OF BIRTH:     100270             SEX:               1 = MALE
NATIVE LANGUAGE: _ = ENGLISH          CITIZENSHIP:       1 = US/RES
VISA TYPE?        __                  RACE CODE?         0 = UNKNOWN
HOUSING APP:      3 = RES/H/COM       BC STAFF CHILD:    _
ALUMNI CHILD:     _                   FIN AID APP:       _
EARLY NOTIFICA:   _                   ENT COLLEGE?       01 = A&S
ENTRANCE MAJOR?   69 = UNCLASSIFIED   ENT PROGRAM:       ___
NURSE PROGRAM?    _                   SPECIAL CASE:      _
DISABILITY:       _                   APPLICATION FEE: 45
******************************* MESSAGES ************************************
*                                     TO POST, PLEASE ENTER YOUR PASSWORD  *
*                                                                          *
```

FIGURE 3



```
AR16 122333444              REQUEST MAILINGS                 MONTANI  02/07/92
NAME: SMITH,JOHN                  STAGE: A = APPLICANT ( SOURCE? __
ADDR: 1 MOUNTAIN VIEW ROAD BOSTON MA 02167
DISPLAYING:  001 - 007 OUT OF 007
OPTIONS: A=REQUEST MAILING, D=DELETE MAILING, +=TOP, -=BOTTOM
 YR/CODE?      MAILING DESC          LETTER?     LETTER DESC           TAG?
_ 93500 A  1993 ALL INVITATION LETT ADL50002 summer invitation        _____
_ 93610 A  1993 FRESHMAN VIEWBOOK                                      _____
_ 93611 A  1993 FRESHMAN BULLETIN                                      _____
_ 93661 A  1993 AHANA BROCHURE                                         _____
_ 93664 A  1993 VISITING B.C. BROCH                                    _____
  =====    ========================= ======== ===================== =====
_ 93620    1993 TRANSFER BROCHURE                                      _____
_ _____                              ________                          _____
_ _____                              ________                          _____
_ _____                              ________                          _____
_ _____                              ________                          _____
_ _____                              ________                          _____
_ _____                              ________                          _____
_ _____                              ________                          _____
_ _____                              ________                          _____
_ _____                              ________                          _____
******************************* MESSAGES ************************************
*                                                                          *
```

FIGURE 4

will appear with all the valid entries on the table of states called "STATEZIP". Then the user may select the code and return to the original transaction.

When a high school student applies for admission, he/she submits a preliminary application. This data is entered into an on-line transaction called AD02 - Create an Applicant (FIGURE 3). If this student is on the Prospect/Inquiry File then this screen will display all of the biographical information available. Some Prospect/Inquiry data is entered manually, but a lot of it is loaded from vendor tapes. Therefore, the data gathered during the prospect and inquiry stages saves valuable time for the Admission staff. Once the applicant information has been verified this transaction updates the inquiry file and creates an applicant record.

The applicant record is associated with the applicant's social security number which allows SAT, ACT, and Achievement Test Scores to be entered directly on the applicant's record. The program processing these tapes also updates the applicant forms tracking system, and the student's interests are recorded on the Prospect/Inquiry file. After an application is entered into the recruitment system several processes take place. The first item that gets created is a label for the applicant folder. The second item is a mailing label that is used to send the secondary application packet to the applicant. The system can also generate other labels and customized letters based on defaults controlled by the Admission office, and by jobs that have standardized programmed selection criteria, and jobs that have adhoc selection criteria. For example, all applicants will receive an undergraduate bulletin because the Admission office has set that as a default.

Once a record is in the system it can be updated by on-line transactions and batch programs. The system monitors the type of contact that the university has with each student that causes a file to be updated. In this way the system always reflects the current stage of each prospective student in the recruitment process.

5.3 Managing and Tracking Event Information

Once an inquiry or applicant is recorded in the recruitment system they may receive specialized recruitment materials that target the groups most in demand at Boston College. Some students will be sent a video. Others will receive one of several newsletters and/or customized departmental letters based on applicant's interest areas. In this way, the chairpersons and directors of various academic programs on campus can participate in the recruitment process.

The Admission Recruitment System also provides for on-line selection of many mailings. FIGURE 4 illustrates a screen called AR16 - Request Mailings. This screen displays the mailings that have already been sent to a prospective student, and the on-line request defaults. The blank lines at the bottom of the screen permit the user to enter other mailings that the student may have requested. Note that all mailings can be tracked on the activity file which collects data about mailings and events. One of the goals of tracking this information is to determine which recruitment activities work. For this reason it is very important to maintain summary statistics for each event and type of mailing. Various on-line screens allow the Admission staff to review what has been sent to each potential student and his/her response to invitations, telethons, high school events, etc. FIGURE 5 shows AR03 which displays all summary information available for events. If the data exceeds a single page then it will scroll as necessary. In the example shown event summary statistics are displayed, with the beginning of the event description and location.

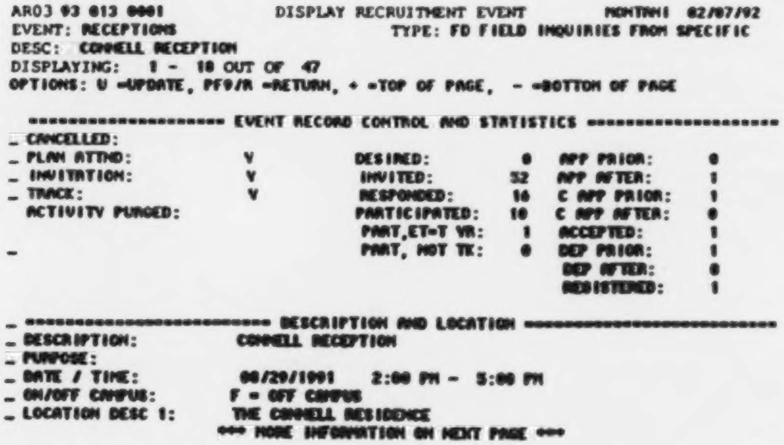
Summary statistics for events are also summarized by a batch program (AR0110) illustrated in FIGURE 6. This event summary report can be used to compare events of the same type for a single year or for several years at one time. It helps identify which events were most successful in turning:

(1) prospects into inquiries,
(2) inquiries into applicants,
(3) applicants into completed applicants,
(4) accepted students into deposited students, and
(5) deposited students into registered students.

This report is a valuable tool for the Admission staff because it permits a comprehensive review of their efforts by highlighting data about crucial points in the recruitment cycle.

5.4 Managing and Tracking Mailings

One of the key design features for the new system was coordination. In prior years the Admission office had to deal with 4 separate adhoc label batch jobs and 2 adhoc letter jobs. Now they only have to deal with 1 adhoc label job and 1 adhoc letter job. These adhoc programs can select from the Prospect/Inquiry file, the Applicant file, and the High School file, and have all the functionality of all the replaced jobs. Flexibility was also a concern in the development process. For this reason the system allows the combination of like mailings into a single run of the label printing program. It also allows the type of label, the label format, number of copies, address, and sort order to be changed at any time before printing the labels. Information can also be recorded for each batch to indicate the offices and vendors involved with each mailing. Lastly, the new system gives the Admission office the ability to control which groups of labels will be printed. By doing so, waste has been reduced by eliminating batches that were incorrectly selected before they are printed. All of this control is processed centrally through an on-line

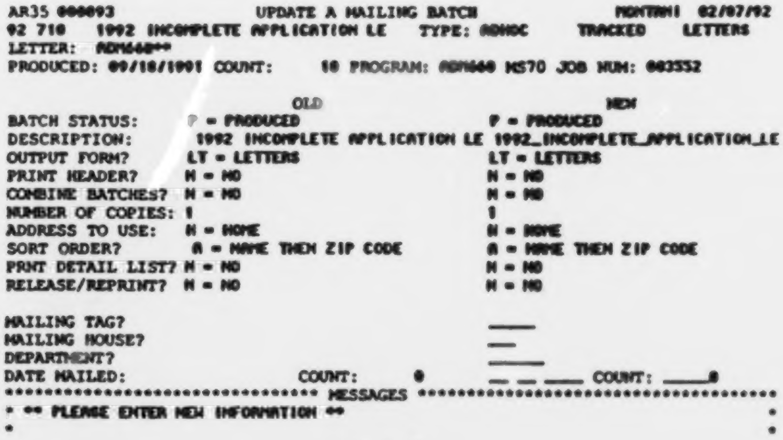


```
AR03 93 013 0001            DISPLAY RECRUITMENT EVENT        MONTANI 02/07/92
EVENT: RECEPTIONS                   TYPE: FD FIELD INQUIRIES FROM SPECIFIC
DESC:  CONNELL RECEPTION
DISPLAYING:   1 -  10 OUT OF  47
OPTIONS: U =UPDATE, PF9/R =RETURN, + =TOP OF PAGE,  - =BOTTOM OF PAGE

  ==================== EVENT RECORD CONTROL AND STATISTICS ===================
_ CANCELLED:
_ PLAN ATTND:              Y           DESIRED:          0   APP PRIOR:      0
_ INVITATION:              Y            INVITED:        32   APP AFTER:      1
_ TRACK:                   Y            RESPONDED:      16   C APP PRIOR:    1
  ACTIVITY PURGED:                     PARTICIPATED:    10   C APP AFTER:    0
                                        PART,ET=T YR:    1   ACCEPTED:       1
_                                       PART, NOT TK:    0   DEP PRIOR:      1
                                                              DEP AFTER:     0
                                                              REGISTERED:    1

_ ========================= DESCRIPTION AND LOCATION ========================
_ DESCRIPTION:              CONNELL RECEPTION
_ PURPOSE:
_ DATE / TIME:               08/29/1991    2:00 PM -  5:00 PM
_ ON/OFF CAMPUS:            F = OFF CAMPUS
_ LOCATION DESC 1:          THE CONNELL RESIDENCE
                          *** MORE INFORMATION ON NEXT PAGE ***
```

FIGURE 5

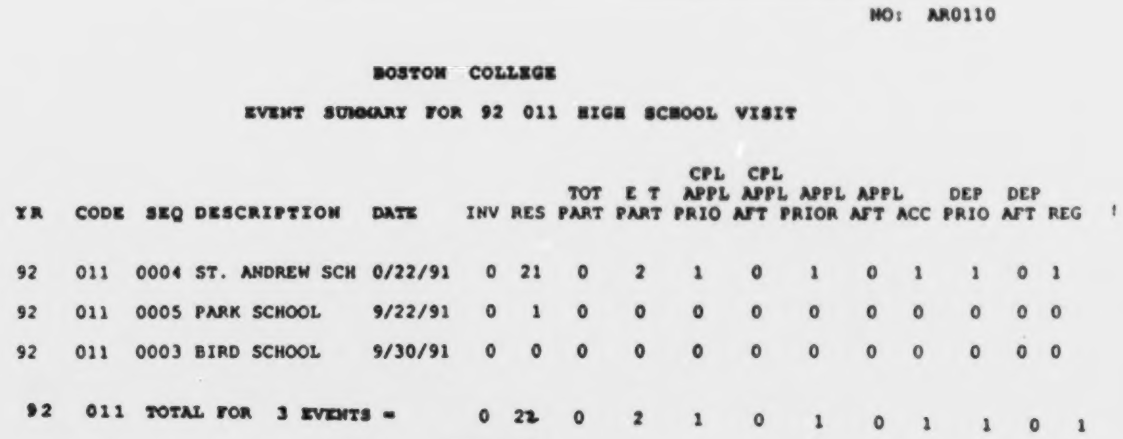


```
AR35 000093                UPDATE A MAILING BATCH              MONTANI 02/07/92
92 710    1992 INCOMPLETE APPLICATION LE   TYPE: ADHOC      TRACKED     LETTERS
LETTER:  ADM660**
PRODUCED: 09/10/1991 COUNT:      10 PROGRAM: ADM660 MS70 JOB NUM: 003552

                              OLD                                  NEW
BATCH STATUS:      P = PRODUCED                        P = PRODUCED
DESCRIPTION:        1992 INCOMPLETE APPLICATION LE 1992_INCOMPLETE_APPLICATION_LE
OUTPUT FORM?       LT = LETTERS                        LT = LETTERS
PRINT HEADER?      N = NO                              N = NO
COMBINE BATCHES?   N = NO                              N = NO
NUMBER OF COPIES: 1                                    1
ADDRESS TO USE:    H = HOME                            H = HOME
SORT ORDER?         A = NAME THEN ZIP CODE             A = NAME THEN ZIP CODE
PRNT DETAIL LIST? N = NO                               N = NO
RELEASE/REPRINT?  N = NO                               N = NO

MAILING TAG?                                           ____
MAILING HOUSE?                                         __
DEPARTMENT?                                            _____
DATE MAILED:                    COUNT:      0          __ __ ___ COUNT: ____0
******************************* MESSAGES *************************************
* ** PLEASE ENTER NEW INFORMATION **                                          *
*                                                                             *
```

FIGURE 7



```
                                                                    NO:  AR0110

                           BOSTON COLLEGE

                EVENT SUMMARY FOR 92 011 HIGH SCHOOL VISIT

                                                   CPL  CPL
                                        TOT  E T  APPL APPL APPL APPL      DEP  DEP
YR   CODE  SEQ DESCRIPTION    DATE  INV RES PART PART PRIO AFT PRIOR AFT ACC PRIO AFT REG

92   011   0004 ST. ANDREW SCH 0/22/91  0  21   0    2    1    0    1    0   1    1   0  1

92   011   0005 PARK SCHOOL    9/22/91  0   1   0    0    0    0    0    0   0    0   0  0

92   011   0003 BIRD SCHOOL    9/30/91  0   0   0    0    0    0    0    0   0    0   0  0

92    011  TOTAL FOR  3 EVENTS =        0  22   0    2    1    0    1    0   1    1   0  1
```

FIGURE 6

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transaction that is called AR35 - Update a Mailing Batch, which is displayed in FIGURE 7.

To handle the large number of mailings a screen was created to show the current status of all mailing batches. This screen permits the system manager in the Admission office to monitor how things are running. This screen displays batches of labels and letters. The most recent status of each batch is listed with the status date and the status count. Of course, this screen permits the user to transfer to other screens for more information about each batch by entering one of the option codes in the field at the left hand margin of each line. In addition to simplifying the production of labels and letters the new system tracks every mailing. Every piece of mail that is sent out is recorded by batch and by type. In this way summary statistics are compiled which tally the number of pieces of each type of mailing that were sent in each year. At the detail level a record exists for each piece that was mailed to each prospective student. In this way a comprehensive record of the correspondence between the university and the prospective student is compiled. Linking the mailing and event information is one of the advantages of the new system. The Admission office is always interested in the chronology of mailings and events that proved successful. With the new system this data is available through AR17 - Browse Prospect Detail. This screen combines all of the information from the Activity detail file with certain "milestone" dates stored on the Applicant file.

6. IMPLEMENTATION ISSUES

6.1 Top Management Support

While the Dean of Enrollment Management and the Director of MIS were instrumental in initiating the project they continued to be involved throughout the planning process. They also participated in the user training sessions. Their support played an important role in the success of this project.

6.2 User Involvement in System Development

6.2.1 System Design Stage

User participation in every system development phase was critical to the successful implementation of this system. One of the key factors that contributed to a smooth system implementation was the Admission users' commitment to this project. They were very cooperative in dedicating their time to work with MIS staff on defining the system requirements. Just like every office, the Admission office staff has a busy daily schedule. However, they were very responsive about participating in the system design and analysis process. Screen design and functionality for the new on-line transactions were reviewed with the users before programming was started.

During this review the details of each transaction's functions were specified. This eliminated major changes from being requested by the users later in the project, and provided good specifications for the MIS programmers.

6.2.2 Testing and Training Stages

A new approach was adopted on system testing and training during the implementation of Admission Recruitment System. In addition to taking a traditional approach to test the new transactions one by one, it was suggested that group testing of the transactions would be more efficient and effective. The Admission staff and the Dean of Enrollment Management were invited to the Information Technology training room with an overhead screen projector (40 x 40) and a terminal set up for each participant. MIS staff presented the new transactions and introduced the system functionality to the users while each participant tried out the transactions themselves.

This testing process helped the users understand the overall process and gave them the opportunity to ask questions about the new system features built in the on-line CICS transactions. The group participation also promoted user appreciation and acceptance of the new system and the new way of doing their business. User feedback was reviewed by the project team after each group session. Some of the comments were followed up with system modifications to accommodate specific needs. By involving the users early on in the testing stage, training was spread out over time and the users became comfortable with the new transactions and office procedures before the production implementation took place.

6.3 On-line Documentation

All CICS transactions and batch programs are documented on-line. Users may access the documentation through their terminals by typing "HELP" or "DOCU". MIS documented each on-line transaction as it was written. This made the user training and learning process more effective.

6.4 Post Implementation Review

It was strongly recommended that a post system implementation review be done to evaluate the system after it was in production for at least 6 months. At this review, the users expressed their appreciation on how the new system made the recruitment process more efficient and more effective. Admission's ability to collect more information about their constituents enhanced their personalization efforts and enabled them to study how or why students become connected to BC. Applications for the class of 1996, which is the first class being recruited with the new recruitment system, are up significantly. While it is not measurable at this time, Admissions thinks that the new system helped play a role in this increase.

6.5 Workstation Upgrades

The complete analysis of workstation issues including mainframe connectivity was submitted to the management in October 1990. A Capital budget request totalling more than $90,000 to implement this plan was approved by the Executive Director of Information Technology within a month. Many new terminals were installed by January, 1991. Every Admission staff member had a workstation to access the mainframe by October, 1991. Without the extended connectivity, the Admission staff would not have been able to access to the extended data base in a timely and efficient manner. With the timely delivery of technology including proper hardware and software development the Admission staff have been able to track all recruiting events and activities to implement the enrollment managements strategy.

7. CONCLUSION

When rewriting the Admission system MIS learned a great deal about the complexity of the recruitment process. As a result MIS formulated a plan to integrate many disjointed processes in a new administrative information system. This system brought a significant change to the way the Admission staff work and interact. More data is captured under the new Admission Recruitment system and is distributed more widely than ever before. Many new options and help features were built into the system to assist the Admission staff in using the new screens. At the same time, many controls were built in to help manage and summarize the huge volumes of data that pass through their office.

Overall, the admissions files are completely integrated. The status of each potential student is closely monitored and all significant contact with that student is recorded. In this way the staff who handle calls from prospective students are more aware of the degree of interest and the type of information that the caller has already received from Boston College. The new system provides the Admission staff with a new tool to track the prospects, inquiries, and applicants. It changes the way they do business. The new system produces timely and correct management reports for top management decision making and generates the necessary letters and mailing labels for prospective students. As a result of this new system, the coordination among academic departments and other offices is increased. The net result of all these changes is a more informed and responsive Admission office that is ready to aggressively pursue its recruitment program.

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M4-2
Implementation of a User-Oriented DB2 General Ledger System

Kay Royston
Louisiana State University

IMPLEMENTATION OF A USER-ORIENTED DB2 GENERAL LEDGER SYSTEM

Kay Royston
Senior System Analyst
Louisiana State University

INTRODUCTION

Accounting at LSU

LSU, like many universities, is funded from several sources. It is a state university; therefore, a large percentage of its funding comes from Louisiana state appropriations. Because it is also a land grant and sea grant university, federal appropriations contribute significantly to LSU's funding. Fees and tuition, private, state and federal grants, and self-generated monies from auxiliary enterprises round out the funding sources. Each type of funding must be accounted for, and in the case of state and federal appropriations and grants, different rules and restrictions apply to the expending of the funds and reporting requirements. Another complication arises with respect to fiscal year. The state fiscal year runs from July through June; the federal fiscal year runs from October through September; grants must be accounted for the duration of the grant which may cross several fiscal years.

LSU provides centralized accounting services which consists of Payroll, Purchasing, Accounts Payable, Accounts Receivables, General Accounting and Financial Statements functions for LSU at Baton Rouge, several satellite campuses within the LSU System, and the LSU Foundation. Financial statements must be generated separately for each campus or entity and then combined to produce consolidated financial statements. Therefore, each campus or entity has its own set of funds which must be accounted for, balanced and reported. The funds which may be defined for each campus or entity are Current Unrestricted (appropriations), Current Restricted (grants, contracts, fees, tuitions, etc.), Current Restricted Auxiliary Enterprises (self-generated monies), Loan, Endowment, Unexpended Plant, Renewals & Replacements, Retirement of Indebtedness, Investment in Plant, Agency, LSU Foundation Endowed and LSU Foundation Non-Endowed.

At LSU, debits and credits are accumulated in accounts defined in each fund for each campus or entity. There are two types of accounts in the LSU accounting system. The General Ledger accounts consist of asset, liability and fund balance accounts. Subsidiary accounts are used to accumulate the detail necessary to support the General Ledger fund balance accounts. Typically, only the centralized accounting services departments are concerned with General Ledger accounts. The majority of financial users in each department or college is only interested in subsidiary account information.

To facilitate the detail reporting that is required by state and federal governments, as well as granting agencies, LSU has defined object codes to categorize each debit and credit. For example, there are different General Ledger object codes to distinguish a Payroll liability from an Accounts Payable liability in a General Ledger liability account. Subsidiary object codes are used to identify different types of personnel expenditures, travel expenditures, operating services expenditures, etc.

Original Accounting System

LSU's original accounting system was written in the early 1960's. It was a batch system that primarily used tape files. It was written for DOS and later converted to O/S. Accounting entries were written or typed on forms in each department or college, routed to accounting services for approval, keypunched and batched for daily update of a month-to-date transaction files. Year-to-date accounting files were updated monthly.

The design of the system limited the expansion of funds. Unrestricted, Restricted and Auxiliary monies were combined in a Current Fund and had to be manually separated for reporting purposes.

The system also required manually generated control (fund balance) account entries. Most accounting entries (purchases, personnel expenditures, travel expenditures, etc.) originate in the department or college by secretaries, department heads or principal investigators who have little understanding of accounting principles. However, they had to prepare entries that not only affected their subsidiary accounts, but that also affected general ledger fund balance accounts. The burden of verification for these entries fell on the centralized accounting services departments.

Very limited reporting capabilities were provided by the system. General ledger object codes did not exist to identify categories of liabilities or assets in an account. As a result, there were many general ledger accounts to maintain which often led to confusion and errors.

Access to the accounting files for ad hoc reporting were restricted to the centralized accounting services departments because there was no way to secure the financial data except at the file level. Anyone with access to the file would have access to all campus, fund, account and object information.

New Accounting System History

By June, 1985, it was clear that the existing accounting system did not meet the financial needs of the University. Phase 1 of a new accounting system project was begun. Interviews with high level administrators were conducted and several problems were identified. First, the administrators wanted more timely information. There was no record in the system of accounting transactions that had been initiated at the department level but were awaiting approval by the college or accounting services. The second problem had to do with inadequate reporting capabilities. There was also an overwhelming demand for project accounting. And finally, security issues were raised. Access by account must be provided. With the conclusion of the interviews, the decision was made to purchase accounting software.

Phase 2 of the project began in September, 1985. A team of accounting and data processing personnel began to evaluate the University's financial needs and to evaluate software packages to determine how closely they would fit the needs. In May, 1986, the team chose a vendor and made a recommendation.

The administration decided to accept the team's recommendation and contract negotiations with the vendor started in May, 1986. The contract was finalized in September, 1986.

From September, 1986 through June, 1987, the system was installed and personnel were trained. The LSU Foundation was to begin operating with the new system in July, 1987, as a pilot project.

In June, 1987, the vendor defaulted on the contract.

In August, 1987, it was decided to begin in-house development of an Integrated Financial System. LSU already had an on-line Purchasing system with which the users were very satisfied. It uses IMS databases (IMS DB) running under IMS data communications (IMS DC). However, enhancements were required for integration with the Accounts Payable and General Ledger systems. The Accounts Payable batch system was replaced with an on-line system which uses DB2 relational databases running under IMS DC. The Chart of Accounts tape/VSAM batch system was replaced with an on-line system which uses DB2 databases running under IMS DC.

By September, 1989, the foundation had been laid and the design for a new General Ledger system was begun. Coding began in June, 1990. The system was put into production for training and testing in April, 1991. In July, 1991, LSU had an operational Integrated Financial System.

G/L SYSTEM FEATURES

Audit Controls and Data Integrity

Audit controls are necessary to insure the accuracy of the data in the system. In the General Ledger system this is accomplished by defining entry rules, allowing users to enter their own data, providing means to reduce mistakes, and providing daily balancing and cash reports.

Prior to the new General Ledger system, many of the audit control and data verification functions were manual, time-consuming tasks. For example, some grants would allow equipment purchases while others would not. Very few relational front end edits were in the original system. Any errors that were not detected by visual verification had to be identified by after the fact reporting and then correcting entries had to be made. The new system supports on-line data entry at the point of origin (i.e., department) with full front end edits and two levels of overrides for exception processing. This provides more accurate data, fewer corrections and more timely approval processing in the accounting services areas.

The General Ledger system does not require manual control entries to be made. An understanding of accounting principles is not necessary to use the system. Many offsetting entries are automatically generated (exploded) by the system to insure each fund remains balanced. These entries are transparent to the departmental personnel who initiate transactions.

For the convenience of data entry personnel, to standardize certain types of entries to reduce errors, and to decrease the actual typing of redundant data, the General Ledger system provides the capability to create on-line forms. These on-line forms replace paper forms on which certain types of information (e.g., account codes, object codes, amounts, descriptive information, etc.) were pre-printed. When an individual initiates an accounting entry, a form may be referenced. The form is displayed, missing data is keyed in and an entry which combines the form data and keyed data is created.

Another data entry shorthand feature that is built into the system for convenience and which reduces mistakes allows the user to "pull down" information (e.g., account code, object code, amount, description, etc.) from a previous line using the ditto mark.

Daily reports are produced to document the integrity of the system. The effect of each day's transactions on the system are reported. Detail amounts are compared to summarized totals. Fund balancing reports are designed to show very high level totals for each fund for each campus. Cash reports show the cash position of each bank account and can be balanced back to the fund reports.

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Management Reporting

While evaluating the financial needs of the University, it became apparent that there were two types of reporting needs. In addition to the typical financial reports (balancing reports, control reports, ledgers and financial statements), deans and directors demanded management reports to aid in fiscal related decisions, forecasting and historical reporting. Detail transactions and balances by account and object have been made available on-line. To provide for other more specific ad hoc reporting needs, managers are able to extract with an on-line transaction the information which they are authorized to view. Their own DB2 tables are then created. They may use SAS or QMF to access their tables without affecting on-line response time. They may even download the information to a PC for spreadsheet applications. Because it is available upon request, managers control the frequency and content of the extracted data.

Approval Processing

One of the primary complaints about the accounting system in the past concerns the timeliness of the data. Departments which initiate accounting entries want to see the effect on their balances immediately. Accounting Services did not want balances affected until they approved the entry. The routing of a paper document from department to department could take several days. It was difficult for deans and directors to know an accurate account balance without manually tracking entries en route. The new General Ledger system provides tentative and current balances and an approval tracking function from the point of entry. Transactions entered at the department level are initially incomplete until the operator indicates that he has finished the data entry process. At this time, the entry is edited and balanced. If no errors are encountered, the entry becomes pending, tentative balances are updated and the entry is ready to be printed for the paper to be routed for approval. When Accounting Services receives the paper document, they change the status of the entry from pending to either approved or disapproved. If it is approved, the paper is routed to General Accounting for appropriate filming and filing. General Accounting then releases the entry to become current. Each night released entries are "exploded" to create the system generated offsetting entries and current balances are updated.

Project Accounting and Subobject Codes

Project accounting seemed to have as many definitions as the number of people asked to define it. It was determined that to meet the needs of financial data users, it was necessary to allow object categories to be further broken down by each department. Since Accounting Services has no interest in reporting or controlling entries at a lower level than object code, a subobject code field was incorporated into the General Ledger system to be defined, maintained and monitored at the department level. This was a viable alternative to project accounting for many departments. However, there were still some users that wanted to subdivide an account into multiple projects and others that wanted several accounts, or accounts and objects, to be combined into a single project. Accounting Services now establishes projects on an as need basis in much the same way that accounts are established. Accounting Services also defines and maintains project rules which identify project and account relationships. The system edits each transaction that references a project number to insure that it is a valid project; it is valid with the specified account and the project is not expired. On-line and printed project ledgers are provided for project accounting users.

Account Level Security

It was necessary to provide account level security to identify the users that may access financial information for each account in the system. This is an on-line function that is maintained by Accounting Services. LSU's account code structure allows a masking concept to be used to define account level security. For example, a department may have several accounts and several users that need access to those accounts. It would be a maintenance nightmare if each user had to be individually related to each account for which access is to be established. Campus, college, department and the source of funds for each account is built into LSU's account numbers. Thus, instead of having to define an authorization rule for each account, one rule can be defined for all the accounts in a campus, college, department or source of funds.

In addition to account masking, user IDs are grouped together into a User ID String. This allows all the users in a department to be granted access to all the accounts for that department with one rule. Security may be defined either for an individual user or the user group.

It was also necessary to provide access to accounts by update and inquiry functions, or inquiry only. The ability to define this access, in conjunction with account masking and user groups, allows Accounting Services to easily maintain adequate security restrictions. All access to financial data is validated against these rules.

On-Line Help

In keeping with the goal to provide a user-oriented system, on-line help has been included in the system. Help text is created and maintained in DB2 tables by Accounting Services. The help text can be divided into subsections that may be selected individually in much the same way that TSO/SPF help operates. Each G/L screen has help text associated with it. When a user presses the help key, the help text is displayed. When the user is ready to return to his screen, the end key is pressed. The user's original screen, with all data intact, is returned.

Rules and Code Tables

In an effort to provide a flexible, low-maintenance system, the General Ledger system was designed to use rules and codes for relational edits and to generate programmatically offsetting entries. For example, each accounting entry must specify an account number, a transaction type (budget entry, encumbrance entry, expenditure entry, etc.) and an object code. Information in the rules and code tables are accessed to validate that the transaction type is valid and may be used with the account number, that the object code is valid and may be used with the account number, and that the transaction type may be used with the object code. Accounting Services defines and maintains the rules and code tables. The rule tables define account/object code relationships, account/transaction relationships, transaction type/object code relationships, explosion rules and project rules. These tables allow Accounting Services more control over system edits and the flexibility to change the edits without programming changes. When these types of edits were hidden in a program, there was some confusion about what was actually done. There were also occasionally communication problems between Accounting Services and the programmer. Now that the rules are stored in DB2 tables, it is easily accessible for anyone to view.

G/L SYSTEM SIZE

At implementation time, LSU was running MVS on an IBM 3090-600E mainframe. The primary on-line operating environment was IMS DC with DB2.

Over 300 users (many first time computer users) were trained initially. There has been ongoing training for new personnel and advanced training sessions for more experienced users. Accounting Services has coordinated all of the training.

There were 253 programs written. There are 81 on-line screens and 33 regularly generated reports. There are 13 G/L DB2 tables. The 3 main tables are the Entry table with an estimated 500,000 rows, the Detail table with an estimated 2,000,000 rows and the Totals table with an estimated 1,000,000 rows. There was an average of 10 people involved for about 12 months in the development effort.

In addition to the development effort, a major conversion effort was made to modify existing systems, such as Payroll, Purchasing and Accounts Payable, to be able to generate accounting entries for the new system. Not only was there a new transaction format, but there were also new project number and subobject code fields that had to be added. There were 18 systems, 375 programs, and 17 IMS or DB2 database modifications required by the conversion effort.

CONCLUSION

The decision to use DB2 tables allowed the development of a user-oriented General Ledger system in less time that it would have taken if IMS databases were used. Relational database processing is much simpler than hierarchical database processing. More tools were available for the developers to access information in DB2 tables than with IMS databases.

The DB2 User Register in conjunction with the DB2 Security table allows users access to their data without violating security restrictions. It also allows the authorization rules to be defined in one place and maintained by Accounting Services, not a Database Administrator.

Because of LSU's Entity Relationship Modeling approach to designing the DB2 tables needed in a system, the users were involved in more detail and at an earlier stage in the project than with previous development projects. They gained a better understanding of the integral design of the system and they were forced to define a solid foundation for the system at the beginning of the project.

Allowing Accounting Services to be responsible for rules, codes, security and on-line help functions is advantageous to both Accounting Services and Administrative Information Systems (AIS). The users are more in control of getting what they want, when they want it without impacting AIS schedules and without any misunderstanding between what they want and and what they get. They are also more sensitive to the changes that are made. They have a much better understanding of how rules relate to each other and what the effect of a change in one area will have on another area. Therefore, they can make more informed decisions about what changes are necessary and what changes may not be worth the effort to make.

Even though there were many years between Phase 1 and the implementation of the General Ledger system, Accounting Services and AIS remained committed to delivering a system that meets the financial needs of the University and the needs of all financial users. During these years the needs were constantly assessed and re-evaluated. The end result is a system that works for LSU.

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What is the Reality of Virtual Reality?

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WHAT IS THE REALITY OF VIRTUAL REALITY?

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"Virtual reality, the creation of highly interactive, computer-based multimedia environments in which the user becomes a participant with the computer in a 'virtually real' world" (cited in Helsel & Roth, 1991, back cover) is being popularized by scholars, educators, information scientists, philosophers, artists, and others. But what actually is it? What applications exist today? What if any are its implications for education? Do other technologies do the same thing? This paper will explore these questions by defining the terms, exploring some of the current applications, reviewing the implications for education and discussing the technology's future.

OVERVIEW AND DEFINITION

The term virtual reality is almost like an oxymoron, a combination of contradictory or incongruous words. Virtual or artificial reality enables users to become participants in abstract spaces where the physical machine and the physical viewer do not exist but where the viewer perceives the environment to be real.

Webster's Dictionary defines virtual and reality as follows: Virtual--"being in essence or effect, but not in fact"; Reality--"a real event, entity, or state of affairs." (cited in Webster, 1971). Thus, virtual reality may be paraphrased as "a real event that is such, in essence, but not in fact."

In essence, virtual reality is an advanced technology in which the user experiences at least the visual sensation of being immersed within the images. This is most notably accomplished through the uses of a wide field-of-view, stereoscopic head-mounted or head-coupled display device.

In a broad, historical perspective, computer-based virtual reality comes from software engineering. Computer scientists use "virtual memory" to mean computer RAM which is memory which the computer uses as if it exists beyond the actual hardware limits. The term virtual from a contemporary standpoint has come to be connoted as an adjective referring to a reality that is not a formal, bona fide reality. Like, virtual mail or virtual work groups on computer networks, or virtual libraries and even virtual universities.

Virtual reality has been popularized by the hardware associated with its use. Stereoscopic head-mounted displays (typically called headsets or goggles) incorporate a small device to track the position of the x, y, and z three-dimensional coordinates and orientation of the head in 3-D space. As the user moves, the images in the display device are updated to reflect these movements. This provides the user with the visual sensation of inclusion within the 3-D model.

Two slightly different computer-generated views are projected on tiny liquid crystal screens inside the goggles or headsets. This produces that 3-D effect for normal vision, created by the physical fact that neither eye is perceiving the same thing from exactly the same perspective. As the user turns his/her head with the headset, the user sees the scenes from differing angles, just as one would in real life. In addition, a magnetic sensor on the headset transmits the changes in the head's orientation to the computer for recalculation of the viewpoint presented on the screens inside the headset. (cited in Bylinsky, 1991, p. 138) The reader can sort of think of the virtual reality helmet as two Sony Watchman with a head tracking system on top.

Data gloves are another popular computerized equipment which is associated with virtual reality. This instrument with optical fibers and sensors measures the position of the hand and the movement of the fingers. In essence, the data gloves take the place of a mouse. It allows the user to explore strange new worlds, like the interior of a molecule or the insides of a nuclear power plant still under construction.

The difference in virtual reality and other forms of multimedia is that virtual reality is created by a display and control technology that surrounds its user with an artificial environment mimicking real life. The user interacts with objects and settings as he would in the real world. No passive viewing of computer screens. Although interactive multimedia allows the user to manipulate objects on a touchscreen or with a mouse, virtual reality allows the user to be a full participant in a 3-dimensional setting. The fundamentals of virtual reality require 3-D, a stereoscopic wide-angle view, with the ability for the individual to control the viewpoint so that when the head moves, the interface knows where the head is located.

Others will argue that virtual reality does not require a head-based system. What is necessary is the illusion of being somewhere other than where you are. All the human senses are invoked, including the sixth sense of the experience of time. The other senses seem to sweep the environment, generating complex, multidimensional data for the mind to process.

As with any new advanced technology, virtual reality has become a "hot" buzz word that is now being applied to a wide range of new graphics and display technologies. Virtual reality has been described as a Disney World for epistemologists. (cited in Henderson, 1991)

The literature seems to be using several terminologies interchangeably to represent this user controlled computer environment--virtual reality; artificial reality; cyberspace; and telepresence.

One of the present problems with virtual reality is that it is being defined by many different marketers who want to label it for their own product. Also, there is a danger that popular press, like MTV, ABC Nightly News, New York Times and Rolling Stones, are defining virtual reality in terms of a single system in hopes to attract the visual picturesque.

Possibly the best way to define this new form of multi-media is to quote some of the scholars who are working with the technology:

> "The primary defining characteristics of virtual reality is inclusion, being surrounded by an environment. Virtual reality places the participant inside information."--William Bricken, Principal Scientist, Human Interface Technology Laboratory, University of Washington. (cited in Virtual reality, 1991, p. 1)

> "Virtual reality represents the latest development in human computer interface design. The basic goal is to provide the computer user with a multi-dimensional environment in which to work. This computer generated environment will exploit many of the human's innate sensory skills to enable more effective assimilation of data, through visual, audio, and tactile data. We are attempting to generate not an interface to a computer, rather a completely alternative environment, in which the user directly participates in a computer generated world."--Charles Grimsdale, Division Limited. (cited in Virtual reality, 1991, p. 12).

APPLICATIONS

Virtual reality is not just some "talked about" technology in the research labs. There are applications which are finding their way into commercial operations and even into education.

Some of the commercial applications which are more obvious and understandable include Boeing's simulation of pilot training. Boeing has actually had more than 100 of its engineers and executives fly inside the virtual airplane and has a corporate steering committee to explore potential applications. (cited in Bylinsky, 1991, p. 138). The U.S. Department of Defense used virtual reality for pilot training, particularly during the Middle East Crisis. (cited in Telepresence, 1991) Caterpillar is also exploring virtual reality to improve performance and driver visibility of its earthmovers.

There are marketing applications as well. Matsushita Electric Works in Japan is using the U.S.-built headsets to demonstrate custom-built kitchens in a "virtual kitchen." A customer gives the dimensions of the kitchen and the kind of appliances to a salesperson. This information is put into a computer, the customer puts on a headset and the new kitchen appears before her which she can now move about freely to get a feeling for the space, can open the doors, appliances, and cabinets to make sure that the space is workable. The sales clerk then ships the order to the factory and the customer has her custom-built kitchen within two weeks.

It is conceivable that architects and designers will be the biggest users of virtual reality. Virtus Corp. has a software package which runs on MacIntosh for architects which will be adapted with headsets and data gloves. It allows the architect and the client to view both the inside and outside of a house or building from different perspectives.

Medical applications abound. Surgeons can, in essence, superimpose an image of what the results should look like on a patient. Physical therapists can practice and model certain leg and arm motions for strengthening muscles. Apple Computers, working along side Stanford, MIT, and Northwestern universities, is developing virtual reality systems of the human body to view and study the bodily systems from many angles, thus creating the ability to study stress and tolerance of certain parts of the body to certain procedures. Traumabase, a project supported by the U.S. Army Medical Research Center, applies the virtual reality concept to the study of war injuries. (cited in Henderson, 1991)

Pharmaceutical researchers are wearing 3-D goggles for visualization of molecular structures in hopes of studying the docking mechanism of molecules related to disease control.

Yet, probably the largest possibility at present for virtual reality is in the field of entertainment. The video arcade business in the U.S. will follow suit to that of the United Kingdom with "pay per experience" opportunities. The University of Washington developed a program where a user "flies" like superman over the Seattle skyline, including travelling under the Puget Sound with two whales.

It may not be long before virtual reality is seen in the movie theaters. VPL Research, the company regarded as being in the forefront of virtual reality, has formed a joint venture with a division of MCA to build a series of test theaters within the next two years. (cited in Bylinsky, 1991, p. 150) People will be seeking experiences through theaters, novels, movies and television which involve a new form of physical involvement.

Interactive cultural and sports events are likely to come. Sports is related to theater in that both are refined forms of play. The purpose of virtual reality and cyberspace for sports is not just to help people have fun, but also to stay fit. Sporting houses will rent time on a system. The issue to be tackled will be how to keep every cyberspace deck constantly in use without creating long lines, not untypical of today's problems with sporting equipment.

Eat: A Virtual Dining Room is a single-user experience in which the participant sits in a formal dining room and orders food from a real waiter who serves it on a virtual dinner plate. Other experiences include surrogate travel through a village in Germany. The user becomes the tram by controlling the speed, backward and forward motion, as well as right and left turns. A map illustrates specific locations in relation to the city and video displays convincing details of specific streets, buildings, etc.

There are many public and private organizations which have committed to research and design of virtual reality systems. The University of North Carolina-Chapel Hill is a pioneer in research and development of virtual reality. Some of their applications include: a radiation therapy treatment; a 3-dimensional modeling system of protein molecules; an interactive building in which people walk through; and a mountain bike with force feedback. In the mountain bike experience, participants lose their balance and start to fall off the bicycle even though it is stationary on a platform.

A lot of the work for virtual reality came out of NASA Ames Research Center which developed the Virtual Interface Environment Workstation (VIEW) which allows the operator to explore a 360-degree synthesized image with a wide-angle stereoscopic display unit and glove-like devices and speech recognition technology. Developed by Mark Bolas of Fake Space Labs, NASA Ames Research Center is also utilizing the BOOM (Binocular Omni-Orientation Monitor), a counterbalanced CRT-based stereoscopic viewing device which enables interactive and real-time viewpoint control of 3-D environments generated by a computer or a camera. The BOOM, which is self-standing, provides high resolution and fast tracking. It is said that people can use it comfortably providing up and down motion, 360 degree vision and allowing the user to look away rather than being confined to a headset.

In yet other research, Eastman Kodak engineers have gained new insights into the understanding of polymers for their camera cases with 3-D technology. By understanding how the polymers untangle themselves by actually seeing things in virtual reality that an engineer can't see with an equation, the company has been able to design lighter, thinner parts that require less material and meet environmental standards. (cited in Bylinsky, 1991, p. 150)

IMPLICATIONS FOR EDUCATION

This new technology can have implications for education. Interaction is key to motivation which is key to learning, as has been shown in much research on education. (cited in Palardy, 1990) The greater the participation, the higher the learning. In today's classroom, the experience is mostly passive for most students.

Applying virtual reality techniques should do great things for motivation and learning as education moves from a reliance on written text to imagery and from a reliance on abstractions to experience-based learning. (cited in Helsel, 1991)

For example, mathematics is a "scary" subject for many students. With virtual reality, students could take part in an algebraic equation. Students could take the place of an equal sign or the value of 2X + 2Y in order to visualize relationships.

There is a trend in education from the conceptual to the perceptual. (cited in Krueger, 1991, p. 25) More educators will seek ways to visualize what used to be represented mathematically partly because perceptual intelligence is an ancient acquired skill of mankind.

It has been shown that simpler visual presentations of complex material can increase comprehension to such a degree that even mediocre students become good students. (cited in Bylinsky, 1991, p. 150). More difficult subjects, like quantum physics, could become more understandable if students are submerged in virtual quantum space.

Driver training, criminal justice, and aviation are only a few of the obvious areas that could benefit from computer simulated, interactive, 3-D realistic presentations.

One university currently using virtual reality is the University for the Arts in Banff, Canada, which is bringing 3-D art forms to life.

Museums are likely to begin using virtual reality before schools. What starts as good entertainment actually becomes good education in the long run.

The BOOM also has implications for education and training. Instead of using a joystick or mouse in a 2-dimensional environment wiht a videodisc, the learner could use a BOOM to control a 3-D simulation.

It seems to this author that a first step use of this technology in education may be 3-D audio where the sound is localized in space so that when participants move, the sound stays with them. Only time will tell what actually becomes of virtual reality in education and training settings. Cost will most certainly be a factor, as discussed later in this paper.

FUTURE OF VIRTUAL REALITY

Virtual reality is exhibiting signs of a healthy industry in the making. There are many high-quality, useful products either currently available or soon to be released. It looks like this industry is here to stay.

As with any new industry, it is not without several problems. As with most other high-tech fields, research and development in virtual reality occurs in university, government, and industrial labs. More and new academic sites are occurring for virtual reality at the same time that corporate and industrial funding is decreasing. After university overhead costs are deducted, the funding to the lab is rather limited. In these lean economic times, it would lead one to believe that the industry is idle. But this is not the case. Over the past two years, strategies for the commercialization of virtual reality have appeared particularly in "pay per experience" entertainment systems.

Today, surprisingly, the United States leads in virtual reality development. But as seen with automobiles, semi-conductors and consumer electronics, this lead may not last long. The creation of the technology is only the beginning of an industry. Leadership in virtual reality will be the ability to develop quality, affordable products. The first and only complete virtual reality systems developed for use by the arcade/entertainment industry are designed and manufactured in the United Kingdom. The end-user response to these "pay per experience" systems has been tremendous, with the manufacturer reporting impressive sales figures and profits. (cited in Aukstakalnis, 1991, p. 3)

The question really that is unanswered about virtual reality is if people will wear headsets and goggles to go about their daily business or to use in educational settings. The experience of 3-D movies would suggest that there will be resistance. Immediate candidates for virtual reality are people who have to wear uniforms already, such as pilots, astronauts, and medical personnel. Children will not be resistive, particularly if it creates more realistic video games or to make learning fun.

To counteract this resistance, there is discussion about eyeglasses or even contact lenses. With such small glasses, video cameras can see the face of the user and the graphic reality and the real reality merge so the participants can appear to be sitting on real chairs around each other. (cited in Krueger, 1991, p.24) Another possibility is surround display (like surround sound) where participants do not wear a headset but achieve the same effect. (cited in Telepresence, 1991)

What really matters in regards to the headsets is if the users are able to suspend their disbelief in the illusion that they inhabit apart from their physical bodies. The sole purpose of virtual reality, it seems to this author, is to stimulate the human senses so as to help people believe and to sustain an illusion. Head-mounted displays are merely one means among many, including out-the-window visual displays, 3-dimensional audio displays, motion platforms, force-feedback devices, credible simulation worlds, dramatic tension, high stakes, engaging stories, and social reinforcement. (cited in Walser, 1991, p. 56).

Autodesk, Inc., the organization which adapted CAD/CAM for personal computers, has begun to develop a multi-person capability for virtual reality. This has important potential, particularly for education and sports. The virtual spaces, called cyberspace playhouse, will likely be more lively when persons can interact with each other as well as with computer objects in the cyberspace place rather than through a headset. Autodesk also hopes to implement an operating system for 3-D computing.

It is true that the cost of virtual reality is too high at least for education at present. The current VPL demonstration of NASA's technology costs approximately $300,000 per person. The headsets are about $10-15,000 per set. However, as multimedia and virtual reality merge, as line graphics, stereo, videodisc images and hundreds of other applications merge, the ability to produce low-cost systems with 3-dimensional graphics will occur. This author predicts that multimedia and virtual realities will merge.

Virtual reality has already been brought to a desktop environment. Until recently, the software models using digital video interactive (DVI) technology have been 2-dimensional. However, Censate Corp. is experimenting with 3-dimensional possibility. They are using two digital DVI boards in an IBM personal computer. (cited in Telepresence, 1991) With this, it makes the hardware and software about $25,000 and thus open up the opportunities for virtual reality development and utilization.

One of the greatest uses of virtual reality will be its use with robots when it is coupled with human hands and arms. Nuclear reactor repairs and underwater explorations are already being implemented with the operator in a virtual reality environment simulating the actions of the robot in a remote location.

Virtual reality is not a single, new technology, but is a unique grouping of enabling technologies that have been around for some time. Thus, these existing technologies create certain standards and compatibility issues.

It seems to this author that standards for content of virtual reality may need to be considered. When virtual reality first began being publicized about 10 years ago, the technology was stirring up a lot of controversy because of the suggestion that it would be used for virtual sex. Just as there are standards for movies and television entertainment for the general public, there may need to be similar standards for pre-packaged virtual reality environments. But as always, this will probably be driven by market or product demand.

CONCLUSION

The promise is one of the tremendous power of advanced technologies. Visualization is definitely an indication of the future. The merging technologies put a greater emphasis on integration with fewer lines of distinction. If there is to be the power of virtual reality it will get its enthusiasm from the fact the people comprehend images much faster than they can grasp columns of numbers or lines of text. According to Larry Smarr, Director of the National Center for Supercomputing Applications, University of Illinois, "The eye-brain system is incredibly advanced. We can absorb the equivalent of a billion bits of information per second. But our mental 'text computer' is limited so that we can only read 100 bits/characters per second." (cited in Bylinsky, 1991, p. 142) This means that most of the human brain is dedicated to visual processing and thus virtual reality has a real opportunity for linking the real and the computer world.

Virtual reality is a medium that is emerging out of a new way of thinking about computers and their relationship to human experience. Interactive multimedia puts the display of information under the control of a computer program and the user. Virtual realities are a multimedia environment which provide the user with a sense of participating in realities different from their own. This allows the user to experience things, maybe even from more than one viewpoint of a given scene or from a distant or hazardous environment, that can be transferred to, applied to, and even enrich the everyday life.

FOOTNOTES

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M4-4

Reengineering Concepts for Administrative Processes

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REENGINEERING CONCEPTS FOR ADMINISTRATIVE PROCESSES

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An Era of Change

Economic, political, and social transformations have caused significant changes in higher education during the past decade, and predictions for the 1990s are even more phenomenal. In terms of administrative functions, the escalating cost of higher education will force institutions to find ways to do more with less. With the always present concerns about demographic changes, aging physical structures, global competition, operating budgets, quality education, and so on, higher education is in for an arduous decade (Donald, 1990).

Many institutions are meeting these never-ending changes and demands by requiring that administrative areas be more efficient and effective operations. Organizational structures are changing in many institutions to simulate what has been happening in private industry for a number of years, that is, flatter structures with more point-to-point relationships (McIntyre, 1990).

Implementing a reengineering concept in the planning processes can help institutions discover new ways to meet ever-increasing demands. Technology is an enabling force that can be used with the reengineering concept to help reveal opportunities for meeting the many challenges with advanced and innovative alternatives. It can be used as a tool to help provide accurate and timely information in decision-making processes. However, how institutions plan and organize for change and the implementation of a reengineering concept is a most critical factor.

This paper describes the information technology environment at Virginia Tech and what is being done to define a course of action for meeting challenges with administrative processes and systems. It describes an organization that has been established specifically to implement a concept of reengineering and help constituents throughout the institution face the issue of change.

Distributed Administrative Systems Environment

Virginia Tech has always been advanced in its thinking about administrative systems. In the early 1970s, a decision was made to distribute certain responsibilities for administrative systems. Operational and maintenance functions were assigned to administrative offices, and each office was also responsible for securing personnel to staff the support function. Central resources were able to concentrate on new initiatives and maintain a high level of technical expertise. The influx of personal computers brought another stage to the distribution of information technology. Offices now have the ability to maintain systems in their environment, especially if they feel central systems are not meeting their ever-demanding needs.

A study of administrative systems in 1989 revealed a number of interesting perceptions from end user focus groups. The observations indicated a need to consider the procedures Virginia Tech uses to plan, develop, and implement administrative systems. The perceptions summarized in the 1989 study are listed here.

- A lack of central coordination for distributed activities results in poor planning, duplication of efforts, lack of integrated systems, and inconsistency.
- Certain areas operate in a vacuum and give limited consideration to issues of a global perspective. A limited sense of synergy exists for the administrative systems environment.
- There is no structure or formal process for the planning, development, and implementation of administrative systems. Each office appears to operate within its own rules.
- The definition of roles for specific personnel is unclear in administrative offices that accept responsibility for administrative systems and in the central resources (Donald, 1990).

The failure to provide some level of coordination for distributed activities was a factor in creating an unacceptable environment that was characterized by fragmented, undependable, and nonresponsive systems.

Responsibility for specific activities was undefined. Offices relied on the central Information Systems organization for overall direction and support. On the other hand, Information Systems management felt its responsibility was to develop the system infrastructure (an information architecture) necessary to support a distributed information delivery system, not to take responsibility for any administrative system (Heterick, 1990). Although some responsibilities were identified for both the distributed users and central management, opinions differed greatly.

The observations and indifferences led management to establish an independent administrative systems planning function in late 1989. The function was placed under the direction of Internal Audit and Management Services and was charged with developing a strategic plan and recommending improved methods for managing administrative systems at Virginia Tech.

Administrative Systems Planning

The establishment of the Administrative Systems Planning function was not intended to discourage distributed activities nor to imply distributed efforts were failures. On the contrary, it was established to assist in providing overall direction and to recommend how technologies (such as distributed activities) could contribute to the success of administrative systems at Virginia Tech.

Administrative Systems Planning studied the administrative systems environment at Virginia Tech and peer institutions for over two years. In addition to a strategic plan for administrative systems, several reports were produced over the first 18 months. The major reports provoked some specific actions that have eventually lead to organizational and philosophical changes for administrative systems at Virginia Tech.

- **"Administrative Systems Planning Report."** An assessment of current systems and the evaluation of supporting infrastructures and activities provides findings and critical factors necessary for a sound foundation.

- **"Administrative Systems Project and Organization Report."** This report consolidates several lists from various administrative areas into a list of active projects, a list of potential projects, and strategic initiatives. In addition, the report identifies the need for policies and procedures relating to administrative processes and/or systems.

- **"Operational Priorities for Administrative Systems."** Specific projects are identified and prioritized by administrative offices to chart a future direction. Each project was reviewed and placed in a category based on expected effort to complete (that is, greater than 1 year; 6 months to 1 year; or 6 months or less).

- **"Administrative Systems Strategic Plan 1991-1996."** This is a strategic plan that can be used as a framework for future efforts in the administrative systems environment. As a framework, it provides a supporting structure to use as a basis for any activities.

- **"A Proposal for Organizational Support."** This report is the culmination of several meetings and was an attempt to recommend a reorganization of existing resources and responsibilities.

In addition to the many meetings and reports, outside resources had an impact on the final recommendations. Presentations and papers by information technology professionals on the concept of reengineering had a great impact on proposing a direction for administrative systems at Virginia Tech.

A final step in formalizing the new environment for administrative systems at Virginia Tech occurred in October, 1991. The Administrative Systems Planning function was moved to the office of the Vice President for Information Systems with the intent of establishing a new organization that would facilitate the concept of reengineering and begin a new era for administrative systems at Virginia Tech.

Reengineering: A Concept For Change

Richard L. Nolan presented a keynote addresses at the 1989 CAUSE National Conference entitled **"Too Many Executives Today Just Don't Get It."** The presentation focused on the issue of transforming (or reengineering) business activities in higher education. Nolen proceeded to explain "that "getting it" means understanding what transformation is, what is driving it, and what must be done to transform an organization. Transformation is changing an organization and the principles of managing it in a way that makes the organization viable, productive, and competitive in the information economy of the 1990s and beyond. The state of most organizations today and the way they are being managed will not survive into the 1990s" (Nolan, 1990).

Nolan's 1989 presentation was followed by a few articles and presentations dealing with the concept of reengineering in higher education. Jim Penrod and Michael Dolence, from The California State University, Los Angeles, have published articles about the concept and its implementation in higher education. One CAUSE/EFFECT publication provided features where information technology professionals, as well as college and university presidents, responded to Nolan's remarks. Professional publications, relating primarily to business and industry, have contributed greatly to this concept and left no shortage of reference materials.

Technology publications and conferences are primary sources for reengineering discussions. It is, without a doubt, one of the hottest buzzwords in the information technology profession. Organizational changes, costs, and risks are concerns that are prohibiting many from accepting reengineering and implementing a full-blown program (King, 1991). Others may feel that reengineering is only a fad, a new twist to changing existing applications, or just another gimmick for consultants. Still, it has been stated in several different contexts that reengineering is synonymous with change, and change is forever (Fax Forum, 1991).

Reengineering may not be the best concept for some higher education institutions, but Virginia Tech feels that the concept can be incorporated into planning for administrative processes and systems to improve business activities at the University. The process "focuses on tearing things down and looking with a fresh, technology-oriented eye, rather than revamping or improving existing systems" (King, 1991).

The emergence of reengineering (or in Nolan's context, transformation) is something that many futurists and authors have predicted. Nolan stated that every senior executive and administrator has probably heard about transformation, but many still do not understand what it means (Nolan, 1990). If that is the case, and if an institution wants to implement a reengineering process, then aiding people in understanding that process is extremely important. Virginia Tech has relied on higher education publications and its information systems professionals to develop a reengineering concept acceptable and feasible for its environment.

A Definition for Reengineering

Reengineering has often been defined as a variation of other processes. Definitions have been associated with terms such as quality processes, industrial engineering, strategic information systems, and business processes such as Process Design Concept (PDC) and High Productivity Program (HPP) (King, 1991; Penrod and Dolence, 1991). However, the introduction of a recent CAUSE/EFFECT article included a description that Virginia Tech incorporated into its plans and educational program for University administrators. The article described reengineering as a process for

- "reexamining basic assumptions about the way we do things and rejecting those that do not fit the technological capabilities of today;
- redesigning work processes based upon new assumptions;
- and "thinking out of the box," that is, refusing to be limited by traditions of the past" (Penrod and Dolence, 1991).

Whether reengineering is considered a methodology, process, structure, or transformation, its purpose is to help organizations change the way they think about doing things. Virginia Tech views the concept as a way for information systems to be proactive in defining, not only systems, but the way things are done at the institution.

Justification for Reengineering

Institutions of higher education are in a climate of constant change, but many are not prepared to meet the challenges ahead. Institutions are facing level or reduced operating budgets, yet they are expected to continue meeting educational needs. State and federal government involvement is increasing with more pressure on personnel and environmental issues. The competitive climate for faculty, staff, and students is placing more pressure on institutions to provide services that will be attractive. Even with these challenges, the greatest concern for all institutions of higher education might certainly be rising costs. If higher education is to survive, it must find innovative ways to deliver its product, establish more cooperative ventures, and, administratively, do things better in a less expensive way, or, do more with less.

Business and industry are realizing that capital and human resources will not solve all their problems and assure success. "Service, quality, speed of response, and innovation are now the operative forces. The rapid changes with which we all must deal mean that actions based primarily upon past experiences may no longer be valid. We have entered a time where applying new knowledge first is key" (Penrod and Dolence, 1991).

The need for reengineering in higher education administrative processes seems obvious. Colleges and universities must develop new models and standards to enable them to meet the challenges of their rapidly changing world. If they are to achieve greater effectiveness and meet the productivity demands of the next century, then they must recognize that significant forces are driving the need to reengineer their organizations.

Quality administrative systems in higher education continue to be a key factor in containing costs, improving staff productivity, providing accurate and timely decision-making information, and enhancing services to all constituents -- internal and external. Incorporating a reengineering concept in the administrative systems environment may pay benefits to those directly and indirectly associated with the institution.

Implementing a Reengineering Process

Doubts certainly exist about the need for reengineering in higher education. The process promotes change and involves risks, but the positive impacts appear to outweigh the negative. Although potential costs for reengineering are a concern, Virginia Tech feels the process can be implemented with existing resources and that benefits will justify any additional costs. However, the key to implementing a reengineering process is having the necessary support.

Donald Langenberg, Chancellor for The University of Maryland System, responded to Nolan's transformation concept by placing it within the framework of a revolution. Langenberg stated that "revolutions are not democratic, in the sense that a popular consensus must develop before anything can happen. All it takes is a few dedicated revolutionaries who do "get it." Then it will happen" (CAUSE/EFFECT, 1991). Virginia Tech has a few of these revolutionaries who are leading the effort to incorporate a reengineering program in their planning processes. Penrod and Dolence amplify Langenberg's view by emphasizing that leadership may be the key to a successful reengineering program (Penrod and Dolence, 1991).

The leaders (or revolutionaries) have to provide the initiative to "sell" the reengineering concept to senior administrators. This effort is extremely important and involves some very important steps.

- The first step in this process is to recognize the need for reengineering. Administrators must understand that most processes in use today were never thoroughly analyzed or thoughtfully designed. Many were results of automating an existing manual process (Davenport and Short, 1990). If some of the familiar examples are used, administrators will begin to recognize the deficiencies and a need for change.
- The second step is to gain support from the administration and have it "publicly" endorse the reengineering concept. The concept is not one that should be a crusade of the Information Systems organization; it must take a top-down approach, and visible administrative support is essential (Alter, 1990).

- An important third step is to adopt a more horizontal approach to planning for the institution. Nolan refers to information technology shifting from a spectator sport to a participatory sport for senior administration. Information technology planning needs to be an integral part of the institutional planning process. There must be a vision and a sense of how information technology can complement the institutional mission and goals (CAUSE/EFFECT, 1991). Information technology leaders have to become part of the team and contribute to overall institutional planning.

- Finally, there must be an organizational structure that can be a facilitating and enabling force in the reengineering effort. Any such organization will be impacted by current structures, but information technology professionals will be expected to provide leadership in implementing the reengineering concept.

An Organization for Reengineering

Defining an organization to facilitate the reengineering concept requires careful evaluation of what needs to be accomplished and who can get the job done. Because no consistent view existed on how administrative systems should be supported at Virginia Tech, the task of recommending an organization was given to Administrative Systems Planning and the Office of the Vice President for Information Systems. In January, 1992, the new department of University Systems Analysis and Services (USAS) reporting to the Vice President for Information Systems was established. A formal recommendation to senior administrators to formalize this department was presented and approved. USAS provides direction and leadership for administrative systems and incorporates a philosophy that integrates reengineering concepts into the planning process. This approach, or methodology, was adopted after reviewing work done by Administrative Systems Planning and evaluating institutional needs to meet the ever difficult challenges of a changing environment.

Organizational Philosophies

Deficiencies within the administrative systems environment indicated the need for an organization that would be responsive and provide leadership. Identifying characteristics of such an organization helped define how USAS functions and what is expected of specific groups.

- USAS is only responsive to invitations received from senior management (that is, Vice President or higher).
- Vice Presidential areas are responsible for establishing priorities for potential invitations.
- The USAS organization is "project driven" so that available resources can be effectively utilized.
- Each USAS project team consists of quality and aggressive personnel with both diverse and advanced expertises.
- Methodology guidelines are available to assure consistency for analysis and development of project plans.
- Each project accepted by USAS is approached with an open mind, analyzed with a global perspective, and requires participation from all those affected by changes.

- Rapid development and implementation techniques are used to ensure shorter turnaround for projects accepted by USAS.
- Administrative offices secure and maintain sufficient staff to accept responsibility for production and maintenance after a process and/or system is operational.

Administrative processes at any institution of higher education are opportunities to impact cost, quality, service and innovation. An organization with these philosophies helps Virginia Tech anticipate changes, recognize opportunities, and progress to strengthen the administrative environment.

An Information Systems Function

The reengineering effort is not a crusade of Information Systems; it is a total University effort. The USAS organization is part of Information Systems because, along with Administrative Systems Planning, it has been supportive in implementing reengineering as part of the planning and development process. Once the reengineering effort was approved by senior administrators, it was clear information systems professionals should provide the leadership (Alter, 1990) because they

- tend to have a greater university-wide perspective of issues;
- are usually experienced in working with management from many areas of the University (can help facilitate cross-functional discussions) (Alter, 1990);
- have a visionary perspective that is useful in looking at transformational issues;
- are accustomed to systemic thinking;
- possess a willingness to challenge the way things are done; and
- understand and recognize the technological opportunities available for new initiatives.

It seems logical that any reengineering effort can best be implemented if the leadership is provided by an organization accustomed to change on a day-by-day basis.

Critical Operational Issues

The implementation of any process, system, or concept is not complete without a list of critical success factors (or in this case, operational issues). This does not mean the previous information in this discussion should be taken lightly. The reengineering concept can not be implemented successfully unless the areas of justification, strong administrative support, a comprehensive planning environment, and the appropriate organizational structure are in place. Once these commitments are apparent, one can move forward in planning and implementing operational procedures that provide direction and assure success.

Planning

The planning environment for administrative processes and systems is very important to the success of reengineering efforts. Institutions often operate with a "fly by the seat of your pants" approach and simply try to maintain operations. Unfortunately in many institutions, operational changes and external pressures often dictate the need for any new efforts. As a result, the planning is normally done in a reactive mode and does not provide optimal benefits for administrative operations. Many planning environments in higher education are also fitting for planning in a vacuum, which hinders individuals from recognizing the benefits of change (Donald, 1990). Consequently, the focus is not on global perspectives and how changes to the way business is conducted might benefit all, but the planning process "stays within the boundaries." This type of planning process increases the exposure to risks (in terms of excessive costs and inadequate systems) and reduces available opportunities to capitalize on technological advances.

The University System Analysis and Services (USAS) group operates in an aggressive and proactive planning environment. The group advocates global thinking (knocking down the boundaries), participation, flexibility, and teamwork. An immediate task of the USAS staff is to prepare a 10-year strategic plan for administrative systems that provides a unified vision of actions and directions for overall university planning.

Priorities

Establishing priorities for administrative systems is a complex task and one that some organizations are reluctant to address (Donald, 1991). Determination of a top priority must be decided by the administrative offices in conjunction with senior management. The USAS organization at Virginia Tech has proposed that priorities be set at the vice president level and, if appropriate, at the senior vice president level. This procedure will create two priority lists, one each from the chief academic officer and the chief business officer.

An USAS executive advisory committee integrates the two priority lists into a single list for project assignment. The group will examine each project on the basis of a strategic framework, project scope, resource requirements, constraints, and active projects. This process will assure that projects recognized by the administration as critical to the University are addressed and handled in the most efficient and effective manner.

Personnel

Perhaps the most important ingredient in the success of any reengineering effort is personnel. The strategy is not unlike a sports team: good players in strategic positions with the necessary role players is a good strategy to be successful. The immediate reaction from many organizations is that such people do not exist within the company (or university), and they may also be unaffordable. Virginia Tech has found the right personnel for the tasks among existing resources and received full support in reallocating several faculty and staff positions. USAS management initially searched within the university (faculty, staff, and even students) to locate individuals who possessed certain skills needed in this undertaking.

Rapid and major change in the work environment is not easily accepted by personnel; however, change is what reengineering is. Therefore, assembling a critical mass of innovative people who can deal with change and aid others is crucial (Penrod and Dolence, 1991). USAS management at Virginia Tech continues to search out senior personnel who possess the abilities to serve the institution by providing

- vision and innovation in solving problems;
- a bias for action;
- quick identification of waste;
- the ability to think horizontally and across administrative boundaries;
- confidence and maturity to set aside egos and be a team player;
- a knack to "blue sky" and think big;
- an awareness of current technology and future treads;
- understanding of the University mission and processes;
- an ability to anticipate future higher education reaction to trends, threats, and opportunities; and
- an interest in helping Virginia Tech in a most difficult and challenging period (Fax Forum, 1991).

Assembling a staff with these qualities is important and will help create a new responsiveness to University administrative functions and systems.

Methodology

Since reengineering techniques are in developmental stages, no proven methodology is available. However, some guidelines should be available on how to proceed and how to present a project in a consistent manner. As in any production process, means must be developed to move from start to finish. An initial methodology has been initiated by the USAS group to use in its first projects, but will, in all likelihood, be modified several times before any final procedure is selected.

Once an invitation has been extended by an administrator to USAS and the project has been selected for resource allocation, the following steps may be used.

- Organization of project team
- Project definition and objectives
- Project analysis and recommendations
- Formal contract for services
- Detail implementation plan
- Management and peer reviews
- Final packaging for full operation

The purpose in listing the steps in this methodology is not to suggest an absolute procedure, but merely to stress the importance of some structure in procedures for reengineering efforts.

Systems Analysis and Design

Reengineering requires that people think differently about how things are done, and this includes encouraging information technology professionals to view systems in a more open manner. The basic design criteria must change from a focus on the primary user (registrar, comptroller, etc.) to one that looks beyond the boundaries where others are impacted. Penrod and Dolence refer to several key principles of reengineering, but only a few of them have been emphasized in the early stages of reengineering at Virginia Tech.

- Compress linear functions - capture information only once. Delays, entry errors, and the overhead of duplication can be eliminated.
- Analyze the way work is done - realign, redistribute, and consolidate the way work is done to enhance operations and reduce inefficiencies.

- Reposition decision and control functions - restructure work flow to locate decision points closer to where work is performed, thereby improving most operations.
- Implement appropriate technologies - evaluate processes based on the above principles to determine what (if any) technologies can contribute to improvements (Penrod and Dolence, 1991).

The point is often made that the information technology organization is the first area where reengineering concepts should be implemented. This may be correct since the process used by systems personnel is critical to the success of analysis and change.

Adaptation to Special Needs

All needs that will develop and be created during the reengineering efforts cannot be anticipated. Management must be flexible and adapt to the environment in order to create an organization that will eventually stabilize and provide the necessary services. One unexpected need that developed during efforts at Virginia Tech was handling day-to-day requests for those organizatjons that do not have distributed support staffs (that is, an ongoing maintenance function). Although the number is low, the need arose, and providing some alternative for that service was necessary. A resolution was finally adopted requiring some "flexible" planning on the part of USAS and administrative offices.

A number of critical issues arise whenever an endeavor of this type is undertaken. The issues listed in this section simply provide information on the experiences at Virginia Tech but, more importantly, alert others that planning for these issues will ease some of the difficulties.

Conclusion

This discussion provides some insight into reengineering efforts at Virginia Tech. The USAS organization was established to deal specifically with administrative systems and to assure that a new, aggressive, and innovation approach is used in these areas. USAS was established in early 1992, and will most certainly stabilize, but it will always be changing.

In the past, many people have believed technology is the answer to all ills. Over the years, an awareness has become apparent that this is not true. Jack Southard (1990) published a "Viewpoint" in CAUSE/EFFECT on unrealistic expectations from technology and then contrasted what technology can really do. That "Viewpoint" is frequently shared with USAS personnel, University administrators, and others at Virginia Tech. Southard's observations are listed here to encourage all to make the transition from unrealistic expectations to realizing what power technology does possess.

- Unrealistic Expectations
    - Technology cannot make up for poor management;
    - Technology alone cannot change the fundamental way business is conducted;
    - Technology cannot define itself;
    - Technology cannot eliminate human mistakes.
- The Enabling Power of Technology
    - Technology can help in making better decisions;
    - Technology can help in dealing with change;
    - Technology can greatly facilitate and often automate the most mundane tasks;
    - Technology offers an opportunity to look at things differently (Southard, 1990).

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M4-5
Computer Performance Behavior and DASD Management

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COMPUTER PERFORMANCE BEHAVIOR AND DASD MANAGEMENT

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The single most critical resource affecting the performance behavior of a computer system is PERIPHERAL activity. In a typical data processing center the bulk of the peripheral activity centers around the disk-DASD units. Therefore, management of the DASD system effectively equates to the management of the data processing system.

To fully understand how DASD imparts this critical impact, it becomes necessary to briefly discuss the elements of a computer system's performance behavior attributes. For the purpose of simplicity, this discussion is limited to a single CPU computer system.

Current technology is sometimes described as the capability to accomplish multiple functions (or jobs) running in the system. If we were to interrogate the status of a machine at a given moment in time, we would certainly find a number of batch jobs running concurrent with a teleprocessing (TP) system. Typically the TP network includes a group of local as well as remote terminals. To each user of a terminal, it appears that they have the attention of the host computer system. These users are satisfied as long as the computer responds to their demands for work within a reasonable time frame (seconds). The details of how the host computer accomplishes this phenomenon is often not understood by the users.

Keep in mind that a computer is an extremely simplistic device. Just as any man must put his trousers on "one leg" at a time, a computer must accomplish its work "one instruction" at a time. The statement that a computer is concurrently accomplishing work for a multiplicity of jobs is a myth, perpetuated by the oversimplification of the actual details of how an operating system actually functions. All work to be accomplished in a computer system must communicate with the operating system many times. The detail sometimes overlooked is that this interfacing (or switch) to and from the operating system invokes a large number of instructions. Recall that a computer does one instruction at time. If the operating system is executing instructions, all other programs in a system must wait their turn.

Now let's discuss the DASD peripheral activity.

Each time that a program requires a transfer of data, it must switch to the operating system to invoke the actual read or write function. Since these commands are considered "privileged," only the operating system can execute them. One other item to remember, although the I/O path can progress through a peripheral activity independent of the computer, it will impact the computer system in two ways. First, during the actual transfer of data between the peripheral device and the memory within the computer, the instructional capability of the computer must wait for the memory (which is a serial resource) if the input-output requires that resource. Second, when the peripheral transfer is completed, the computer's instructional flow is halted again to service the "interrupt" command issued by the I/O path.

One indicator of a computer's ability to accomplish work is sometimes referred to as "MIPS," or millions of instructions per second. A CPU rated at 1 MIP would require .001 second (1 millisecond) to execute 1000 instructions. Be assured, anything that an operating system accomplishes requires thousands of instructions, and even on our fastest most powerful systems of today, this equates into time measured in milliseconds. Some manufacturers will argue that time spent in the operating system providing services such as issuance of I/O functions should not be counted as overhead. Also they will sometimes include as service, such items as paging activity and possibly even the switch time between programs. Nonetheless, it becomes intuitively obvious that the more time spent in the operating system, the less time that is available to execute the production programming activities.

The last item to remember is that current technology implies a degree of concurrency within the computer system, specifically in the area of peripheral activity. Although a single computer can accomplish only one instruction at a time, each peripheral path can also accomplish a single function. In the event that multiple peripheral paths exist, then the system can truly accomplish a degree of simultaneity.

This then provides the necessary background to understand the technology of PERFORMANCE BEHAVIOR and its analysis.

With this knowledge we can graphically portray the computer's behavior by defining a base line of elapsed time and dividing it into four elements.

ELAPSED TIME			
CPU ONLY	CPU & I/O	I/O ONLY	IDLE

CPU Only = The time that the computer is executing instructions, and the peripheral path(s) are not active.

CPU & I/O = The time that the computer is executing instructions and one or more peripheral paths are concurrently active.

I/O = The time that one or more peripheral paths are active and the computer is not executing instructions (sometimes called CPU Wait).

IDLE = The time that neither the computer nor the peripheral path(s) are active.

At this point we can introduce the concept of the busy attribute of a computer system. This is the time that a function is active within the computer and/or peripheral path. We do not consider the system to be busy when a peripheral device is active independent of an I/O path. An example of this would be a device on the byte multiplexor that is active (i.e., a printer), while the CPU and the multiplexor are not busy. In fact, we do not consider the byte multiplexor activity in the definition of I/O paths, since its method of communicating with devices is unique.

ELAPSED TIME			
SYSTEM TIME			IDLE
CPU ONLY	CPU & I/O	I/O ONLY	

Another element of computer behavior requires an additional graphic presentation. This involves a breakdown of the I/O activity into two sub-elements.

<table>
<tr><th colspan="2">Total Input/Output Activity</th></tr>
<tr><td>Concurrent I/O</td><td>Serial I/O</td></tr>
</table>

Concurrent I/O = The time that two or more peripheral paths are active.

Serial I/O = The time that only one peripheral path is active.

These two elements could further be divided into sub-components defined for each element of the elapsed time.

<table>
<tr><th colspan="6">Elapsed Time</th></tr>
<tr><td colspan="5">System Busy</td><td rowspan="2">Idle</td></tr>
<tr><td>CPU Only</td><td colspan="2">CPU & I/O</td><td colspan="2">I/O Only</td></tr>
<tr><td></td><td>Conc I/O</td><td>Serial I/O</td><td>Concurrent I/O</td><td>Serial I/O</td><td></td></tr>
</table>

The last element of this graphic presentation requires a definition of the computer activity. The three sub-elements of the instructional activity include production, service and overhead.

<table>
<tr><th colspan="3">Total Computer Activity</th></tr>
<tr><td>Production</td><td>Service</td><td>Overhead</td></tr>
</table>

These then are the various elements which offer a first level view into the behavior attributes of a computer system, typically referred to as a

"General Systems Profile."

<table>
<tr><td colspan="6">Elapsed Time</td></tr>
<tr><td colspan="5">System Busy</td><td rowspan="2">Idle</td></tr>
<tr><td>CPU Only</td><td colspan="2">CPU & I/O</td><td colspan="2">I/O Only</td></tr>
<tr><td></td><td>Conc I/O</td><td>Serial I/O</td><td>Concurrent I/O</td><td>Serial I/O</td><td></td></tr>
</table>

<table>
<tr><td colspan="3">TOTAL CPU ACTIVITY</td></tr>
<tr><td>PROD.</td><td>SERV</td><td>OVHD</td></tr>
</table>

<table>
<tr><td colspan="2">Total Input/Output Activity</td></tr>
<tr><td>Concurrent I/O</td><td>Serial I/O</td></tr>
</table>

Analysis of the general systems profile should proceed along the lines of the relationship to your objective. In the case that your interest is determining your reserve capacity, then the only element of interest would be the IDLE function. This percentage of time represents the percentage of increase in your work load that could be accomplished without degradation to the current workload. It must be assumed that additional work will behave in the same fashion as your current workload. In the event your CPU is not saturated, additional work could be placed on your system. However, this would cause the existing work to require more time to complete, hence degradation.

Viewing the SYSTEM BUSY percentage, our interest is in the various components and their relative percentages. Since we are running a third generation system, concurrency is expected.

The first element of analysis is to compare the sum of CPU ONLY and I/O ONLY to the value of CPU & I/O. If CPU & I/O is less than the sum of the serial attributes, the system is not functioning as a third generation machine, and we should try to find the reason. Also, if the CONCURRENT I/O is less than the SERIAL I/O, we must determine why we have multiple channels, and why they are not active concurrently.

Observe the TOTAL COMPUTER ACTIVITY. If the time attributed to the PRODUCTION function is less than half of the total time, an investigation should be undertaken to determine the reason. Otherwise, the vendor is paid for a system that runs his programs most of the time.

Typical data processing centers exhibit a profile which includes a large portion of the elapsed time activity related to the I/O, more specifically DASD. If the I/O Only portion is greater than the CPU & I/O, you may have a number of jobs running concurrently using the same peripheral device or using single buffers. In the event that the TOTAL COMPUTER ACTIVITY is smaller than the TOTAL I/O, and work is not being completed on time, a faster CPU will not help.

This then is the context that DASD management must be viewed in.

Traditionally, space was considered the critical resource of the DASD system and required constant control. However, time is another attribute which requires particular attention. As an overview, we can graphically provide a profile of the time attributes of DASD, which includes once again a base line subdivided into three main elements.

DASD Device Busy Time		
Seek	Rotational Delay	Data Xfer

Seek = Time to position the arm to a cylinder.

Rotational Delay = Time to bring the head to the beginning of data.

Data Transfer (Xfer)= Time to pass the actual data.

The most significant portion of the DASD device busy time will be associated with the mechanical motion (seek/rotation) rather than the actual data transfer.

Attributes of DASD efficiency which impact the profile are:

Data Set Placement:	The relative location of active data sets on a device must be carefully considered in the event that they are concurrently active.
Data set blocking:	Blocking must permit a reasonable amount of data to pass in relation to the time required to access the data. Don't forget the time spent in the operating system as well as the mechanical motion time.
Track efficiency:	Each block of data requires a gap or blank space on the track. Blank areas reduce the total amount of actual data that may reside on a device. Also, it requires as much time to pass over a blank area as it does to pass data.
Data set fragmentation:	Data sets that do not reside in a contiguous space require arm motion (seek) and rotational delay as work progresses thru the file. Free space, that is the unallocated areas, can also be considered as a data set for the purpose of assigning new files. One large free space is more usable than many small areas.

From this view point, it can be seen that DASD management must be concerned with both time and space.

One last item to be considered in a DASD management program is the nature of conducting business in the typical data processing shop. Most organizations will provide documented or verbal guidance in the form of standards. Also, most shops will have a backlog of new work to be implemented and an informal mechanism for exceptions of the standards. It is this typical exception element that provides the most troublesome attribute for an automated methodology of DASD management.

What is then perceived is a requirement for a passive form of accountability. This interprets into an automated form of information gathering and a succinct presentation of data. An additional desired attribute is quantification of the impact resulting from actions taken to adjust or improve the DASD system.

With the proper tools to provide an insight into the behavior of a system, it is not unusual to achieve improvements in the amount of work produced, as well as provide adequate notice for expansion requirements. Management must address the subject and direct the effort to achieve the goal.

Finally, having sufficient background to be able to properly discuss a DASD management methodology, an approach to the subject is offered.

There are three prime areas of concern to be considered.

Executive Management:	Non-technical, non-detailed overview, providing sufficient data for decisions.
Space Management:	Identification of empty areas, and guidance to avoid potential performance problems, i.e., contention.
Technical Management:	Full details as to current usage, efficiencies and potential enhancement, including quantification of any and/or all changes.

Executive Management:

With the explosive growth of online storage requirements in the typical data processing shop, management is being asked annually to acquire additional DASD space. Often this request is substantiated by a gut feel on the part of the technical manager. Two unique forms of automated reports remove the necessity of gut feel and quantitatively identify the necessity for the additional space, as well as provide an advance warning for future DASD needs. The first report identifies the current total available space subdivided into three elements.

Total DASD Space Available		
Unused	Allocated & Used	Allocated & Unused

Unused:	Unused refers to space that is not currently allocated to data sets. (A portion of this space will be used by the system as temporary work areas, therefore some minimum of empty space must always be available).
Allocated & Unused:	This term is assigned to the empty space within an allocated file. Several reasons account for these areas. First, they may be empty by design to allow for planned growth in a dynamic file. Alternatively, this space could be excessive based upon erroneous estimates of the actual file size requirements.
Allocated & Used:	This is DASD space that currently contains data. This includes not only the actual live and currently used data, but also the space reserved for such functions as "Paging" and "Accounting data." Unfortunately, it will also contain such items as test data that has not been deleted, as well as data used on a cyclical basis.

The second report contains the same data as above, however, it is maintained in a historical data base. This allows for the presentation of these attributes at regular intervals (suggest weekly). This affords the opportunity to observe changes in the three elements whereby a factual forecast of future requirements can be substantiated. In the event that the technical staff were to undertake an effort to reclaim space, this report quantifies the results of the effort expended.

A number of data processing shops assign DASD space by individual devices to specific users. This is referred to as "Pack Ownership." The users, who are then in control of their own space, frustrate a systems level effort. In this event, it is desirable to hold them accountable by a simple mechanism providing the same set of reports as above, but subdivided by the various control levels (groups) of activities.

With these reports, executive management becomes actively involved in the day to day DASD management at a level of information sufficient for decision making. These reports preclude the necessity of becoming involved in the details.

Typical problems facing executive management often involve a series of tradeoffs. With the multiplicity of devices available today, do we standardize on one device type? Do we buy the cheapest device on the basis of dollars per bytes, or acquire on the basis of storage capacity per square foot of floor space?

The answer, the typical data processing shop should have a mixture of device types.

The latest technology offers massive storage capacity, per mechanical access unit, but it is not practical for the containment of multiple small files that require concurrent activity. Do not become caught in the trap of considering the data transfer time only. Remember that the access or mechanical function typically consumes the bulk of the elapsed time.

Do you retain the cyclical data sets online, because you do not want the bother of an archival system? The same holds true for test information. The only variation between device types worth consideration, as regards test and production data sets, is the block size. Design the program to be independent of device type and block size, and vary this parameter with the JCL.

If you are being pressured into buying the new technology because it will transfer data faster, hold more bytes per square foot, and is the latest thing on the market,will you insist that the data sets be reallocated to achieve these gains? Or, will you simply allow a mass dump to the new devices which will probably result in a loss of storage capacity (due to lower track efficiency), and worst yet, may create a massive bottleneck (contention) in the transmission of actual data.

All of these questions, and more, are legitimate areas of concern and must be addressed by executive management. The reports suggested here provide the framework to assist management in making the necessary decisions.

Space Management:

The time honored tradition of interrogating individual devices as to their empty space, and assigning new files wherever a sufficient area appears, is not only a wasteful effort of manpower but has a negative impact on the performance of the system. Consider the prospect of allowing a new file on a device that contains other data sets that will be active during the same interval of time. This creates the condition called "contention". A simple report containing a total inventory of the empty spaces on the total DASD system, presented in a descending sequence of available tracks with various supporting information, is a better methodology. The supporting information identifies the number of accesses to the device by the existing data sets, as well as the percent of time that the device is busy. (The busy attribute is subdivided by the three shifts). in the event that virtual DASD space is utilized, the empty areas are defined for those spaces specifically. The report thus contains sufficient data for the proper assignment of new files.

One additional insight into the DASD system is provided as a default in this report. Since the DASD empty spaces are presented in a descending sequence, the last items are the smallest available areas. In the event that a large number of small spaces appear, it is prudent to reorganize the specific device(s) to avoid data set fragmentation.

Technical Management:

Information, presented in a decision evoking format, is the key to any management. The care and feeding of a DASD system requires no less. Reports, identifying the total scope of the online DASD must be available in a historical data base to allow for programmatic exception reporting. Data contents and report formats must be succinct. Within a computer the capability exists to provide sufficient data as well as a surplus. Items beyond the control of the individuals may be nice to know, but could hamper a simple and easy-to-read presentation. Reports should be designed such that all pertinent data for a data set is entered on a single line entry with detail that is relevant to the subject matter.

Just as a manufacturer must know what items are in the warehouse, a DASD manager must know what files are resident on the system. This mandates a report containing the entire inventory of data sets. Supporting information includes such items: file created date; last used date; file organization; blocking, extents; percent of allocated space that is used; track efficiency; number of times the file has been opened; number of accesses during the last interval of time; specific location of the data set on the device; and a definition of the function contained in that space, Isam file functions (Index - Prime - Overflow), VSAM file functions (Index - Data -Sequence Sets including catalogs), etc. From this base of information a standard set of reports are produced providing the necessary total inventory, and a set of exceptions are also programmed to produce action reports for such items as:

* Data sets that have been referenced in the past 180 days.

* Data sets that are using less than 25% of the allocated space.

* Data sets that have a track efficiency of less than 50%.

* Data sets that are duplicated in the DAD system.

* Data sets that are contained in more than 10 extents.

* Data sets that are physical sequential and unblocked.

* The 25 busiest data sets.

* The 25 most opened data sets.

* The 7 busiest devices on each of the three shifts.

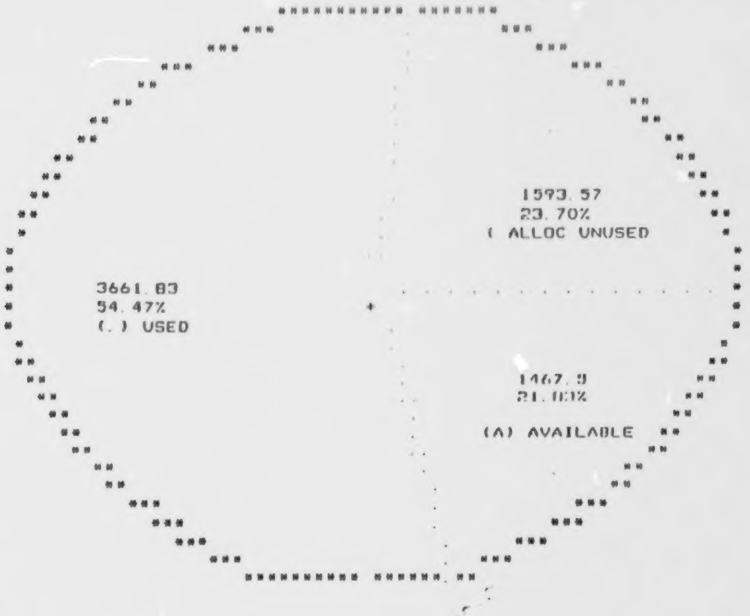
Other areas of concern can then be programmatically addressed, providing the necessary data to assure technical control of the DASD system.

Management Summary:

This approach provides the necessary data for complete control of your Direct Access Storage Devices (DASD). It provides the answers to the classical questions relative to both time and space. Changes to either of these attributes are quantitavely documented in the data base. Reports are generated which encompass the total DASD system, individual devices, and unique data set allocations.

CURRENT DISTRIBUTION OF TOTAL DASD SPACE AS MEASURED IN MEGABYTES

SUM PIE CHART OF BYTES GROUPED BY NUM

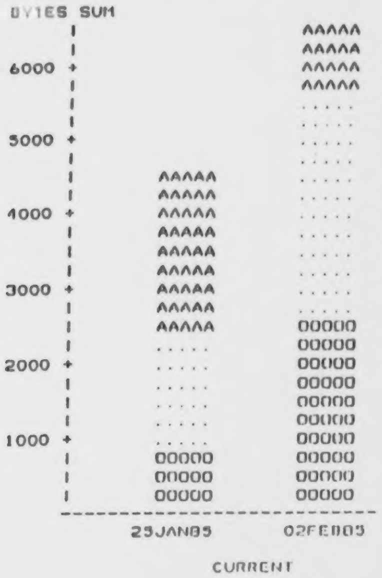


HISTORICAL DISTRIBUTION OF TOTAL DASD SPACE AS MEASURED IN MEGABYTES

LEGEND

O=ALLOC BYTES UNUSED .=ALLOC BYTES USED A=UNALLOC BYTES AVAIL

BAR CHART OF SUMS



```
                              FREE SPACE AREAS

               LISTED BY THE LARGEST AREAS IN DESCENDING ORDER

 FREE                     BEG BEG   END END                        NIGHT    DAY    EVE
TRKS  DSNAME      VOLSER  CYL TRK   CYL TRK     EXCPS    OPENS   %BUSY  %BUSY  %BUSY

4674 *AVAIL*     OPSYS2     0   1   246   1   299732        4    27.2   22.9   26.4
4351 *AVAIL*     DISCPK   579   0   807  18    13287      319    12.3   28.4    2.5
3230 *AVAIL*     OPSYS2   638   0   807  18   299732        4    27.2   22.9   26.4
2587 *AVAIL*     OPSYS3    56   0   192   2        .        .       .      .      .
2310 *VSDSPC     VSAM01   456   0   532  29   185631        7    14.3   12.6   21.4
1805 *AVAIL*     DISK16   314   0   408  18        .        .       .      .      .
 324 *AVAIL*     DRIVE1   196   0   213   0        .        .       .      .      .
  16 *VSDSPC     VSAM01   441  14   441  29   185631        7    14.3   12.6   21.4
   7 *AVAIL*     DISC04   173  12   173  18        .        .       .      .      .
   6 *AVAIL*     OPSYS1   564  13   564  18        .        .       .      .      .
   1 *AVAIL*     PACK06   801  18   801  18        .        .       .      .      .
   1 *AVAIL*     PACK07    74  14    74  14     1136        1     1.6      .    8.2
   1 *AVAIL*     PACK07   583  13   583  13     1136        1     1.6      .    8.2
```

```
                  DETAILED DATA SET INVENTORY
    *(2 addt'l col's on right side not shown, EXCPS and OPENS)
                                .
DSN    VOLSER DO RFM  LRECL BLKSZ CREATED LASTUSE ALO EX  TRKS USED% EFCY%

ACG.C  PACK05 IS FB     112  6272 19APR82 20APR82 ABS 1    152  62.5  96.7
APT61  DISK12 PS FB     160  6400 28OCT82 01NOV82 BLK 1    150   4.0  98.2
BMDP.  UNIT06 PO U        0  3024 09OCT81       . BLK 1     14 100.0  92.8
DUMP.  OPSYS1 PS VBA    125  1632 27APR80 26JAN85 CYL 1    855   0.0  87.7
HASP.  SPOOL1 UK UNK      0     0 10JAN80 21JAN82 TRK 1  15340     S   0.0
MDJC1  DISK11 DA F     3000  3000 26JUL82 26JAN85 CYL 1     19 100.0  92.1
SAS.M  UNIT06 DA U    13026 13030 08JAN82 08JUL82 ABS 1    304  95.1 100.0
VSCAT  LIBARY VS KSDS   505   512       . 02FEB85 TRK 2     28  35.7  71.5
VSCAT  LIRARY VS ESDS    44   512       . 02FEB85 TRK 3     17  17.6  86.5
VTOC   LIBARY DA F      140   140       .       .     1     18   0.0  42.1
```

```
                     DATASET SPACE ALLOCATION

                           EXT  BEG BEG  END END  *** VSAM DS ATTRIBUTES ***
VOLS   DSN FUNCT   DO EXT SIZE  CYL TRK  CYL TRK ETKS TUSD  CIA LUCI CITK
DISC   DDPS        PS   1  228  271   0  282  18
DISC   F01         PO   1    1  193  18  193  18
DISC   F02         PS   1   18  193   0  193  17
DISC   F02         PS   2   38  244   0  245  18
DISC   FILE CYLIDX IS   1   19  190   0  190  18
DISC   FILE PRIME  IS   2 3230    1   0  170  18
DISC   FILE INDOFL IS   3  190  171   0  180  18
DISC   HELP        DA   1   76  254   0  257  18
DISC   LIB1        PO   1   19  181   0  181  18
DISC   M1.F CYLIDX IS   1   19  182   0  182  18
DISC   M1.F PRIME  IS   2   95  183   0  187  18
DISC   M1.F INDOFL IS   3   38  188   0  189  18
DISC   M1.S CYLIDX IS   1   19  194   0  194  18
DISC   M1.S PRIME  IS   2  836  195   0  238  18
DISC   M1.S INDOFL IS   3   95  239   0  243  18
DISC   M1.X        DA   1   38  191   0  192  18
DISC   M1.X        DA   2   19  258   0  258  18
DISC   M2.F        PS   1  123  264   1  270   9
DISC   UAR2        DA   1   19  259   0  259  18
DISC   VCAT LOKRDS VS   1  186  433   0  442  14  124    3 3348   58 27.0
DISC   VCAT HIKRDS VS   2   18  443   0  443  17   12    1  324    6 27.0
DISC   VCAT HILIDX VS   1    3  442  15  442  17    3    1   81    1 27.0
DISC   VCAT LOKRSS VS   2  186  433   0  442  14   62    1   62    1 27.0
DISC   VCAT HIKRSS VS   3   18  443   0  443  17    6    1    6    1 27.0
DISC   VDSP        VS   1  361  433   0  452  18
DISC   VTOC        DA   1   18    0   1    0  18
```

```
                                 NON UNIQUE VSAM SPACE MAP

                                                                   EXT    BEG    BEG    END    END
VOLS     DATA SET NAME                    FUNCT     DO    EXT     SIZE    CYL    TRK    CYL    TRK

VSAM01   Z9999994.VSAMDSPC.T92CF913.T               VS      1     3000    433      0    532     29
VSAM01   CATALOG.YOURCAT1                 LOKRDS    VS      1      109    433      0    439      0
VSAM01   CATALOG.YOURCAT1                 LOKRDS    VS      2      109    433      0    439      0
VSAM01   CATALOG.YOURCAT1                 HILIDX    VS      1        3    439      9    439     11
VSAM01   CATALOG.YOURCAT1                 HIKRDS    VS      2       18    439     12    439     29
VSAM01   CATALOG.YOURCAT1                 HIKRSS    VS      3       18    439     12    439     29
VSAM01   VSAM.DATASET1                    DATADS    VS      1       25    440      0    440     24
VSAM01   VSAM.DATASET2                    DATADS    VS      1       13    440     25    441      7
VSAM01   VSAM.KSDATASET1                  DATADS    VS      1        1    441      8    441      8
VSAM01   VSAM.KSDATASET1                  INDEX     VS      1        1    441      9    441      9
VSAM01   VSAM.KSDATASET2                  DATADS    VS      1        3    441     10    441     12
VSAM01   VSAM.KSDATASET2                  INDEX     VS      1        1    441     13    441     13
VSAM01   AVAILABLE.VSAMD5PC.T92CF--                               16    441     14    441     29
VSAM01   VSAM.DATASET3                    DATADS    VS      1       60    442      0    443     29
VSAM01   VSAM.DATASET4                    DATADS    VS      1       25    444      0    444     24
VSAM01   VSAM.KSDATASET3                  INDEX     VS      1        1    444     25    444     25
VSAM01   VSAM.KSDATASET1                  DATADS    VS      2        1    444     26    444     26
VSAM01   VSAM.KSDATASET1                  DATADS    VS      3        1    444     27    444     27
VSAM01   VSAM.KSDATASET1                  DATADS    VS      4        1    444     28    444     28
VSAM01   VSAM.KSDATASET4                  INDEX     VS      1        1    444     29    444     29
VSAM01   VSAM.KSDATASET3                  DATADS    VS      1      300    445      0    454     29
VSAM01   VSAM.KSDATASET4                  DATADS    VS      1       30    455      0    455     29
VSAM01   AVAILABLE.VSAMDSPC.T92CF--                             2310    456      0    532     29
NEXTVS   Z9999994.VSAMDSPC.T----------              VS      1     (NEXT DEFINED SPACE)

                                   SPECIAL VSAM REPORT

VOLSER   DATASET NAME                                   UNIQ     RECFM     EXT    BOFR

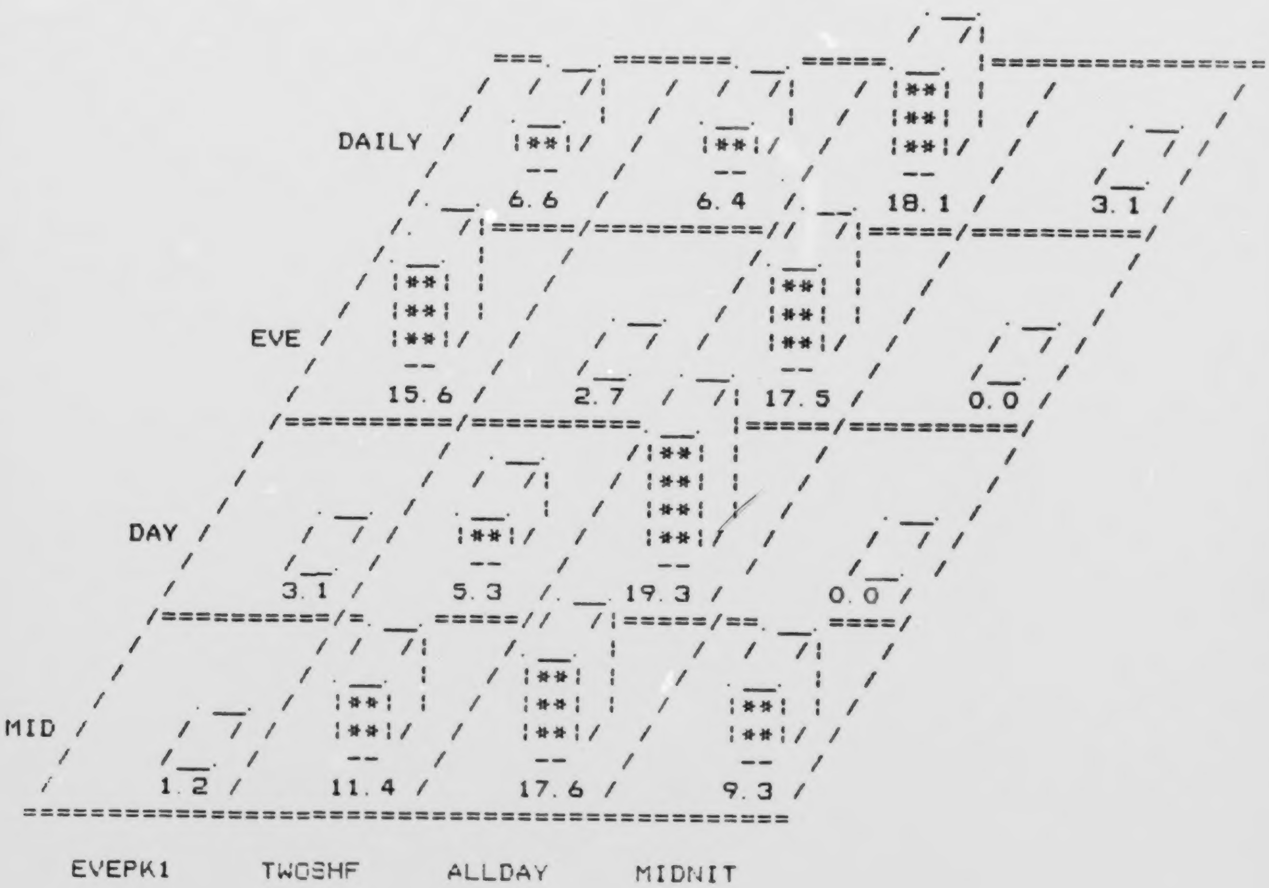
VSAM01   CATALOG.YOURCAT1                                 N      DKSDS       2    3072
VSAM01   CATALOG.YOURCAT1                                 N      IESDS       3       0
VSAM03   VSAM.ENTRYSEQ                                    Y      DESDS      13    6144
VSAM01   VSAM.KSDATASET1                                  I      DKSDS       4    4600
VSAM01   VSAM.KSDATASET1                                  I      IESDS       1       0
VSAM02   VSAM.KSDATASET7                                  Y      DKSDS       1    6144
VSAM02   VSAM.KSDATASET7                                  Y      IESDS       1       0
VSAM04   VSAM.RELATIVE.RECORD                             N      DRRDS       1    1536

            TRKS      TRKS                PCT                                    FREE
BLKS        ALLOC     PER       TOTAL     CI'S     CI       NUMBR     FREE      BYTES     CI       CA
TRACK       UNIT      CA        CIA       USED     SIZE     CI/CA     CI/CA     IN CI     SPLIT    SPLIT


27             3        2        3726      1.8      512        54         0         0         0        0
27             3        1         150      6.5      512        27         0         0         0        0
15            30       30        8100     92.3     1024       450        22       102         0        0
 8             1        1          32     50.0     2048         8         0       102         9        3
27             1        1          27     18.5      512        27         0         0         3        0
15            30       30         450      0.4     1024       450        22       102         0        0
 4             1        1           4     25.0     4096         4         0         0         0        0
27             1        1          27      0.0      512        27         2       102         0        0
```

THE BUSIEST VOLSER's REPORTED FOR ALL SHIFTS

BLOCK CHART OF DBUSY



37th Annual College and University
Computer Users Conference

"Discover New Worlds With Technology"

T2-1

Home Grown Class Scheduling and Enrollment Management System

Ron Bybee
Nobby Muranaka
Brigham Young University

HOME GROWN CLASS SCHEDULING
AND
ENROLLMENT MANAGEMENT SYSTEM

DATA BASED, DYNAMIC, ONLINE, INTERACTIVE

Ron Bybee
Academic Scheduling Officer
Brigham Young University

Nobby Muranaka
Programmer/Analyst
Brigham Young University

INTRODUCTION

At Brigham Young University, only 45% of students entering in pursuit of education complete a bachelor's degree. Many students do not finish more than a year of college before other activities draw them away. Because such a large number of young people will pursue their dreams and goals without a complete college education, it is important that the first two years of education be founded on a rigorous and broad general education that provides usable skills in reading comprehension, analytical thinking, and critical writing. Also, the university experience should assist students in establishing active and healthy patterns of living, and a historical and spiritual understanding of their position in life. To provide such an educational opportunity in a short period of time, it is not only important to design curriculum and provide advisement, but also it is vital to efficiently allocate physical facilities and organize a timetable of courses that allows students regular access to classes. The ability of the scheduling officer to direct the organization of such a schedule depends on timely access to a variety of data.

The management of class scheduling data has been an automated function since 1971. In 1981, ten years later, a dynamic online system replaced the automated batch processing method of scheduling. In 1991, after the development and refinement of Touch-tone telephone registration, the class scheduling system has been converted to relational database and expanded, keeping pace with enrollment management needs. A successful two year development project has resulted in a dynamic online relational database system which provides timely information for scheduling decisions and student enrollment information for class management.

BYU Profile

The university enrolls 30,000 day students and 400 evening students offering 6000 classes each semester derived from 3500 approved courses. The Academic Scheduling Office coordinates class planning with 90 departments within 13 colleges. Three class schedules are published annually for a trimester calendar consisting of two 16-week semesters and two 8-week terms.

The following resources are incorporated in preparing a class schedule:

288 classrooms (17,981 seats)
86 laboratories (2,846 stations)
15 daily instructional hours (7 a.m.-10 p.m.)
5 instructional days (Monday-Friday)

Classrooms are assigned to the colleges and departments according to need (size, number of classes, location, etc.). Academic Scheduling retains 10% of the classrooms to fill remaining demand. Departments schedule the assigned classrooms and then share remaining unscheduled slots with departments within the college. After 30 days of source document planning, unscheduled periods in assigned classrooms return to the scheduling officer to be scheduled for unassigned classes campus wide.

CONVERSION

The programming language is IDEAL, a Computer Associates (CA) product. IDEAL is a language system that provides an interactive environment for the development, maintenance, and execution, of integrated applications. Fill-in-the-blank panels are displayed online and are processed interactively for program, dataview, report, and panel definitions.

The conversion of the class scheduling system from the VSAM file structure to the Computer Associates (CA) Database (DATACOM/DB) structure involved three steps:

1. Redefining the file structures.
2. Redesigning the batch and online processing.
3. Establishing new interfaces with external systems.
    a. Space Inventory
    b. Registration; Online and Touch-Tone
    c. Edited Class Record; Roll Processing

Redefining the File Structures

At the time of class scheduling system conversion, many systems at BYU had changed the file structure from VSAM to relational database which is considered to be a more up-to-date and dynamic technology. Some reasons for the change include:

1. Relational database files do not require reorganization. If the number of records becomes larger than files allow, we can easily expand record space. VSAM files have an insert file for new records. The insert file needs to be reorganized into the main file and be initialized before batch processing.

2. Relational database files have master and alternate keys (access paths to data) where as the VSAM files have only a master key.

3. Relational database structure is easy to change and use.

4. Programs are easily maintained.

The former class scheduling system consisted of three major VSAM files and interacted heavily with a VSAM Space Inventory File and a DATACOM/DB Curriculum File. Class files included:

1. Class Schedule File - class information
2. Class Header File - free formatted information
3. Room Schedule File - assigned classrooms

The key to the record was an unique five digit curriculum identification number. We needed to call up the record by a secondary key, department name and catalog number. This meant that we had to read the curriculum file in order to get the curriculum identification number first before reading the record. Therefore, changes to the curriculum file were dynamically reflected in the scheduling file.

For the new system, eight database files were proposed:

1. Status File - one record per class
2. Schedule File - time, day, room, and building
3. Exam Schedule File - final exam timetable
4. Non-Academic File - special scheduling
5. Room File - all rooms for scheduling

6. Department Preference File - classroom assignments
7. Department Header File - free formatted information
8. Class Header File - free formatted information

The fields in each new file were defined basically from the old files by eliminating the fields no longer needed, and adding fields that were now needed. We defined unique master or native key fields that linked the records together. The alternate keys were defined by data look-up needs. For example, an alternate key contained the instructor's identification number, so that a panel could display the instructor's schedule of classes.

System Enhancements

The following improvements have been gained from the new relational database structure:

1. The schedule file has allowed us to expand time, day, and location information to three lines per class.

2. By storing the instructor's identification number we are able to access the Personnel Department Person-Name File obtaining the instructor's full name each time we access the class record. This identification key also allows us to display an instructor's teaching schedule and credit load.

3. Special non-class scheduling can now be legitimately done without using a dummy department name key.

4. Department and college classroom assignments can be edited and displayed interactively on panels and reports.

5. Parameters can be entered online, processed by batch programs creating the final exam schedule. An exam time, day, room and building assignment is assigned for each class record in the status file.

6. The class schedule phone flag controls the Touch-tone Telephone Registration System. This flag can be set by all courses, by department, by catalog number level, or by individual catalog number.

7. Class scheduling information can be obtained by year-term, department name, catalog and section number, or directly by year-term and curriculum identification number.

8. Information from the curriculum file regarding cross listed classes, flexible titles, or changes of any type are dynamically reflected on the class schedule system.

Redesigning Process

The Scheduling Office staff created a long wish list of functions for the new system. The list was then categorized and prioritized. The critical items were placed on top of the list with the nice but not necessary items put on the bottom.

All the panels were redesigned. The key fields were changed from one long line to multiple lines so that the fields were blocked. This change made the data more readable and the entry of the keys faster with less curser movement. The scheduling staff prepared a mock-up of each desired new panel. The programmer then created the panels making changes where necessary in order to fit all data fields into the panel. The programmer uniquely designed some panels he felt would be helpful in the scheduling process. The final panels were approved by the scheduling officer before proceeding with the programming.

The need to move to Relational Database Technology was the driving force of this redesign. The old system was adequate. Therefore, only a few functional enhancements were needed. We needed to be able to do the things that the old system did first. Taking the wish list items, the method of processing was modified. Writing and testing the programs was a slow process because the scheduling office had to continue regular scheduling and data entry on the old system. We did not do double maintenance with the old and new system. The data from the old files were converted and loaded into the new database format. We went forward! It was truly a team effort to make the new system of programs work. The transition from the old to the new system went smoothly without interrupting external system interface.

Establishing New Interfaces with External Systems

The Office of Space Utilization would not allow the Space Inventory File to be converted to database during class scheduling conversion. Therefore the Room File was created as a subset containing all rooms available for class scheduling. The space inventory terminal program was modified to create a room record by a program-function key and to update the Room File dynamically. This database file was vital for the class schedule system to function. The Office of Space Utilization staff now recognizes the advantages of a database system and realizes they are functionally behind with an older less flexible technology. They have recently decided to convert the Space Utilization System to relational database from VSAM file structure.

Registration programs were converted to interface with the new class schedule system. Touch-tone telephone registration functioned without failure while interacting with the new system.

Class roll and grade processing batch programs require an edited class record. The new system draws dynamic online information from database files such that time consuming editing is no longer necessary.

FUNCTIONS

The online computer scheduling system operates on the university mainframe, AMDAHL 5880 . Visual access by monitor is available to all colleges, departments, and advisement centers. The system provides dynamic information specifying:

Five schedule periods by year term
Classroom conflict identification
Course, title, and credit hour verification
Enrollment, size, and room capacity control
Class final exam schedule
Instructor name by personnel file identification
Free classrooms by search request - Figure 1B

Computer programs provide panels displaying:

Class Scheduling Information - Figure 1A
Department Course Schedule - Figure 1C
Department Course Enrollment Counts - Figure 1D
Room Schedule - Figure 2A
Room Scheduled by Hour and Day - Figure 2B
Instructor Course Schedule list - Figure 2C
Instructor's Schedule by Hour and Day - Figure 2D
Room Available for Class Scheduling - Figure 3A
Curriculum Control File Maintenance - Figure 3B
Class Roll as of Date - Figure 3C
Header/Trailer Information - Figure 3D
BYU Students Added/Dropped

Department/College Room Assignments

Printed report information available upon request includes:

- Room Schedule Lists and Weekly Charts - Figure 4
- Classroom Utilization - Figure 4
- Summary of Class Enrollment - Figure 5
- Room Assignment Needed
- Free Time by Classroom and Building
- Percent of Curriculum by Hour
- Percent of Room Capacity Enrolled by Hour
- Add/Drop Daily Name list
- Final Exam Schedule
- Class Roll

Distributive Data Entry

The new system has been designed with the capability of providing data entry by password from the department office. Decentralized data entry allows department scheduling personnel to interact with all the dynamic system functions to create and proof a schedule within the department before submitting copy to the University Academic Scheduling Officer. For example, a draft of a future semester schedule is keyed over data from the previous year term. Room conflicts, upon occurrence, are displayed instantaneously (Figure 1A). All curriculum information including identification numbers, title, and credit hours are verified as data is entered (Figure 1A). The teacher identification number or instructor name is keyed, verified by the university personnel file, and then generated to the class record. If questions arise regarding instructor availability, individual teaching schedules can be viewed online (Figure 2C, 2D). The scheduled timetable in each classroom can be viewed in chart format to quickly assess open class periods for scheduling. A room search can be conducted by entering the desired building, capacity range, and timetable resulting in a screen display of unscheduled classrooms (Figure 1B). Each course schedule can be listed for quick summary and editing (Figure 1C, 1D). Schedule proofs can be requested for faculty distribution. All these online functions assist the department scheduling staff in preparing a timely first draft schedule to the Academic Scheduling Officer which reduces error and distributes the data entry load.

Enrollment Management

The new class scheduling system interacting with new external systems provides timely enrollment information for faculty and students.

1. **Dynamic Online Counts** (Figure 1C, 1D)
As students register by Touch-tone telephone, enrollments are tallied and displayed dynamically by terminal.

2. **Touch-tone Telephone Seat Availability**
During advance registration, students may request by telephone a voice list of open sections.

3. **Academic Information Management (AIM)**
Terminals conveniently located across campus may be accessed by students to view the class schedule, enrollment counts, and seats available by section.

4. **Electronic Class Roll (ECR)**
Instructors may download by personal computer the class roll (Figure 3C) and employ software to compile test scores and grades for each student. Grade roll upload to the Records Office is now being tested.

5. **Add/Drop Name List**
Student names and identification numbers by class add or drop may be viewed online during the first 10 days of classes. A daily printout may also be obtained for faculty distribution.

These online functions provide dynamic information for faculty management of class enrollment and student access to classes.

Download for Publication Document

The following database files are merged, sorted, and formatted on the mainframe prior to a download through File Transfer Protocol (FTP):

Schedule File
Department Name File
Department Header File
Control File

Course Title File
Person File
Class Header File
Status File

The compiled and formatted class list downloads from mainframe to personal computer in the Academic Scheduling Office. Three computer macros set the font and establish margins, page numbers, field spacing, heading enlargements, and bold highlights (Figure 6). The schedule is accessible by IBM personal computer through a Novell local area network (LAN) operating Word Perfect software. Last minute additions or corrections can easily be made through word processing. The schedule, printed on an Apple Laserwriter, emerges camera ready in 8 point Courier font.

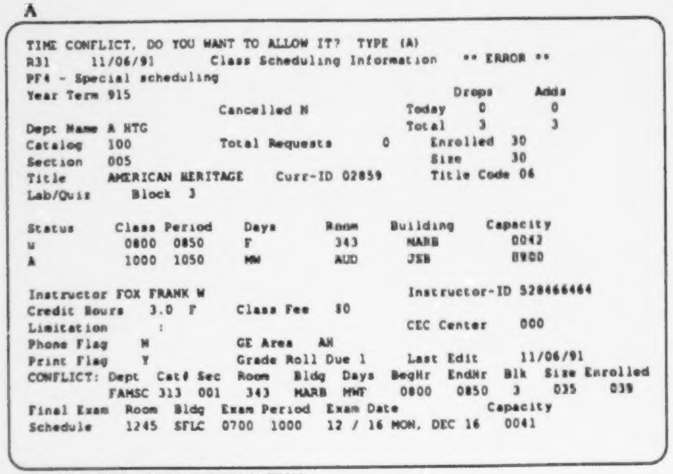
CONCLUSION

Relational database systems comprise small structured files containing related data stored in one place. The keys "relate" or tie the file together. The data is stored and maintained by one department but accessed by many users. A database structure provides a common source of current data in a pre-designed format. The database manager is responsible for maintaining integrity in the system. At Brigham Young University, relational database technology provides an efficient and effective student information system.

Class scheduling and enrollment management has been improved by relational database system development. Information flows freely and dynamically across the campus through online personal computers and terminals. The online class scheduling system assists the Scheduling Officer in efficiently utilizing facilities and providing an accurate and organized schedule of classes. Both students and faculty may conveniently obtain from automated systems current information to facilitate enrollment management and Touch-tone telephone registration.

Figure 1

A



```
TIME CONFLICT, DO YOU WANT TO ALLOW IT?  TYPE (A)
R31     11/06/91       Class Scheduling Information    ** ERROR **
PF4 - Special scheduling
Year Term 915                                          Drops      Adds
                         Cancelled N           Today      0          0
Dept Name A HTG                                Total      3          3
Catalog   100            Total Requests      0    Enrolled  30
Section   005                                     Size      30
Title     AMERICAN HERITAGE    Curr-ID 02859      Title Code 06
Lab/Quiz       Block  3

Status      Class Period    Days      Room    Building   Capacity
W            0800  0850     F          343     MARB        0042
A            1000  1050     MW         AUD     JSB         0900

Instructor FOX FRANK W                         Instructor-ID 528466464
Credit Hours   3.0  F      Class Fee   $0
Limitation        :                            CEC Center     000
Phone Flag     N           GE Area    AH
Print Flag     Y           Grade Roll Due 1    Last Edit      11/06/91
CONFLICT: Dept  Cat# Sec  Room   Bldg  Days  BegHr  EndHr  Blk  Size Enrolled
          FAMSC 313  001   343   MARB  MWF    0800   0850   3    035    039
Final Exam  Room  Bldg  Exam Period  Exam Date            Capacity
Schedule     1245  SFLC  0700  1000   12 / 16 MON, DEC 16   0041
```

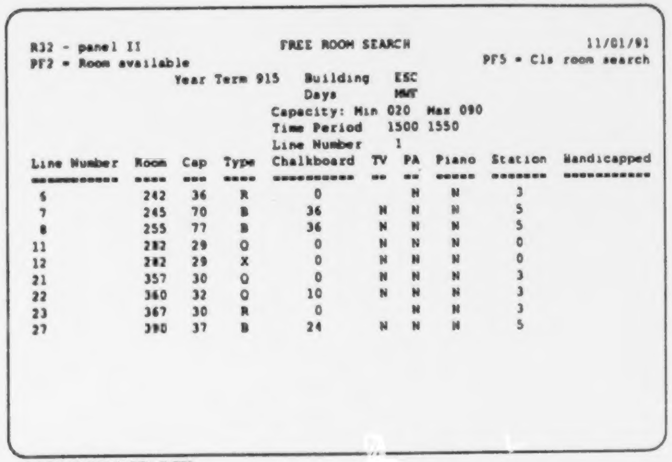
CLASS SCHEDULING INFORMATION

Planning documents reflecting edits and additions are keyed to this screen.

Enrollment counts and add/drop activity are dynamically displayed.

Enter department name, catalog and section number.

B



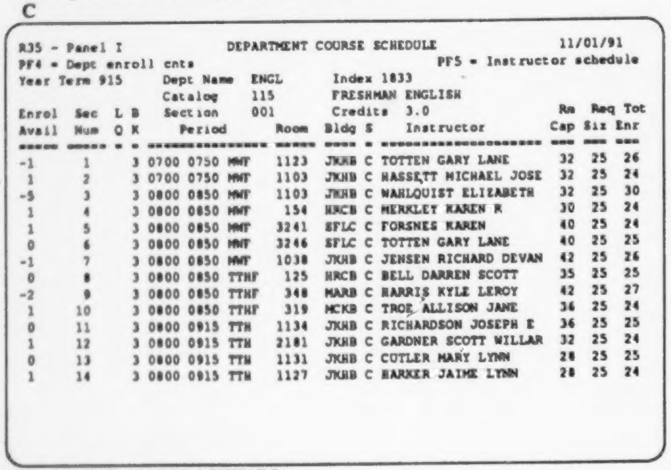
```
R32 - panel II                    FREE ROOM SEARCH                          11/01/91
PF2 = Room available                                          PF5 = Cls room search
                    Year Term 915   Building    ESC
                                    Days        MWF
                                 Capacity: Min 020  Max 090
                                 Time Period   1500 1550
                                 Line Number    1
Line Number  Room  Cap  Type  Chalkboard  TV  PA  Piano  Station  Handicapped
===========  ====  ===  ====  ==========  ==  ==  =====  =======  ===========
 5            242   36    R        0           N     N       3
 7            245   70    B       36       N   N     N       5
 8            255   77    B       36       N   N     N       5
11            282   29    O        0       N   N     N       0
12            282   29    X        0       N   N     N       0
21            357   30    O        0       N   N     N       3
22            360   32    O       10       N   N     N       3
23            367   30    R        0           N     N       3
27            390   37    B       24       N   N     N       5
```

FREE ROOM SEARCH

Identifies open classrooms at specific time.

Enter building, days, capacity range, and time.

C



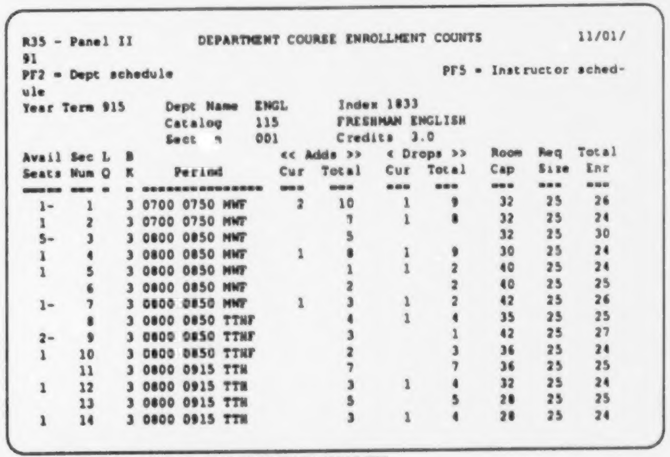
```
R35 - Panel I              DEPARTMENT COURSE SCHEDULE            11/01/91
PF4 = Dept enroll cnts                               PF5 = Instructor schedule
Year Term 915      Dept Name   ENGL        Index 1833
                   Catalog     115         FRESHMAN ENGLISH
Enrol   Sec   L B  Section     001         Credits  3.0                 Rm  Req Tot
Avail   Num   Q K     Period          Room  Bldg S    Instructor          Cap Siz Enr
=====  =====  = = =============== =====  ==== = ==================== === === ===
-1       1      3 0700 0750 MWF    1123  JKHB C TOTTEN GARY LANE      32  25  26
 1       2      3 0700 0750 MWF    1103  JKHB C HASSETT MICHAEL JOSE  32  25  24
-5       3      3 0800 0850 MWF    1103  JKHB C WAHLQUIST ELIZABETH   32  25  30
 1       4      3 0800 0850 MWF     154  HRCB C MERKLEY KAREN R       30  25  24
 1       5      3 0800 0850 MWF    3241  SFLC C FORSNES KAREN         40  25  24
 0       6      3 0800 0850 MWF    3246  SFLC C TOTTEN GARY LANE      40  25  25
-1       7      3 0800 0850 MWF    1038  JKHB C JENSEN RICHARD DEVAN  42  25  26
 0       8      3 0800 0850 TTHF    125  HRCB C BELL DARREN SCOTT     35  25  25
-2       9      3 0800 0850 TTHF    348  MARB C HARRIS KYLE LEROY     42  25  27
 1      10      3 0800 0850 TTHF    319  MCKB C TROE ALLISON JANE     36  25  24
 0      11      3 0800 0915 TTH    1134  JKHB C RICHARDSON JOSEPH E   36  25  25
 1      12      3 0800 0915 TTH    2181  JKHB C GARDNER SCOTT WILLAR  32  25  24
 0      13      3 0800 0915 TTH    1131  JKHB C COTLER MARY LYNN      28  25  25
 1      14      3 0800 0915 TTH    1127  JKHB C HARKER JAIME LYNN     28  25  24
```

DEPARTMENT COURSE SCHEDULE

Provides enrollment summary by section and class timetable.

Enter year term, department name, catalog and section number.

D



```
R35 - Panel II        DEPARTMENT COURSE ENROLLMENT COUNTS                11/01/
91
PF2 = Dept schedule                                      PF5 = Instructor sched-
ule
Year Term 915    Dept Name   ENGL        Index 1833
                 Catalog     115         FRESHMAN ENGLISH
                 Section     001         Credits  3.0
Avail Sec L  B                     << Adds >>   < Drops >>   Room  Req  Total
Seats Num Q  K      Period         Cur  Total   Cur  Total   Cap   Size  Enr
===== === =  = ================   ===   ===    ===   ===    ===   ===   ===
  1-    1    3 0700 0750 MWF        2    10      1     9     32    25    26
  1     2    3 0700 0750 MWF              7      1     8     32    25    24
  5-    3    3 0800 0850 MWF              5                  32    25    30
  1     4    3 0800 0850 MWF        1     8      1     9     30    25    24
  1     5    3 0800 0850 MWF              1      1     2     40    25    24
        6    3 0800 0850 MWF              2            2     40    25    25
  1-    7    3 0800 0850 MWF        1     3      1     2     42    25    26
        8    3 0800 0850 TTHF             4      1     4     35    25    25
  2-    9    3 0800 0850 TTHF             3            1     42    25    27
  1    10    3 0800 0850 TTHF             2            3     36    25    24
       11    3 0800 0915 TTH              7            7     36    25    25
  1    12    3 0800 0915 TTH              3      1     4     32    25    24
       13    3 0800 0915 TTH              5            5     28    25    25
  1    14    3 0800 0915 TTH              3      1     4     28    25    24
```

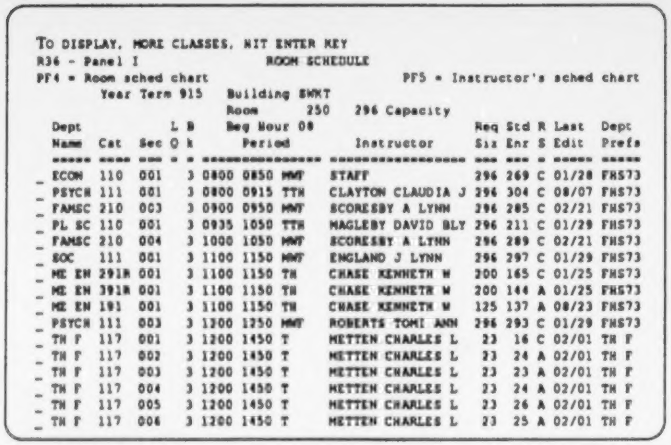
DEPARTMENT COURSE ENROLLMENT COUNTS

Displays add/drop activity by course and section.

Enter year term, department name, catalog and section number.

Figure 2

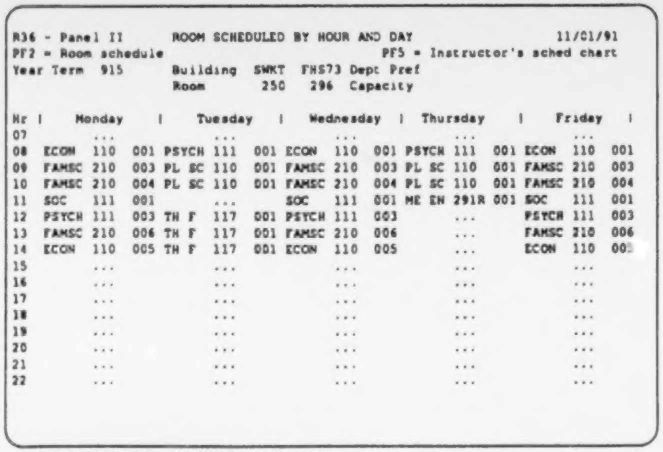
A



```
TO DISPLAY, MORE CLASSES, HIT ENTER KEY
R36 - Panel I                 ROOM SCHEDULE
PF4 = Room sched chart                            PF5 = Instructor's sched chart
        Year Term 915   Building SWKT
                        Room      250   296 Capacity
  Dept              L B         Beg Hour 08                         Req Std R Last  Dept
  Name  Cat   Sec O k         Period            Instructor          Siz Enr S Edit  Prefs
  ===== ===== === = = ================= ================== === === = ===== =====
_ ECON  110   001   3 0800 0850 MWF     STAFF              296 269 C 01/28 FHS73
_ PSYCH 111   001   3 0800 0915 TTH     CLAYTON CLAUDIA J  296 304 C 08/07 FHS73
_ FAMSC 210   003   3 0900 0950 MWF     SCORESBY A LYNN    296 285 C 02/21 FHS73
_ PL SC 110   001   3 0935 1050 TTH     MAGLEBY DAVID BLY  296 211 C 01/29 FHS73
_ FAMSC 210   004   3 1000 1050 MWF     SCORESBY A LYNN    296 289 C 02/21 FHS73
_ SOC   111   001   3 1100 1150 MWF     ENGLAND J LYNN     296 297 C 01/29 FHS73
_ ME EN 291R  001   3 1100 1150 TH      CHASE KENNETH W    200 165 C 01/25 FHS73
_ ME EN 391R  001   3 1100 1150 TH      CHASE KENNETH W    200 144 A 01/25 FHS73
_ ME EN 191   001   3 1100 1150 TH      CHASE KENNETH W    125 137 A 08/23 FHS73
_ PSYCH 111   003   3 1200 1250 MWF     ROBERTS TOMI ANN   296 293 C 01/29 FHS73
_ TH F  117   001   3 1200 1450 T       HETTEN CHARLES L    23  16 C 02/01 TH F
_ TH F  117   002   3 1200 1450 T       HETTEN CHARLES L    23  24 A 02/01 TH F
_ TH F  117   003   3 1200 1450 T       HETTEN CHARLES L    23  23 A 02/01 TH F
_ TH F  117   004   3 1200 1450 T       HETTEN CHARLES L    23  24 A 02/01 TH F
_ TH F  117   005   3 1200 1450 T       HETTEN CHARLES L    23  26 A 02/01 TH F
_ TH F  117   006   3 1200 1450 T       HETTEN CHARLES L    23  25 A 02/01 TH F
```

ROOMS SCHEDULE
Lists room schedule by time and day including class enrollment data.
Enter year term, building and room number. Beginning hour may be entered.

B

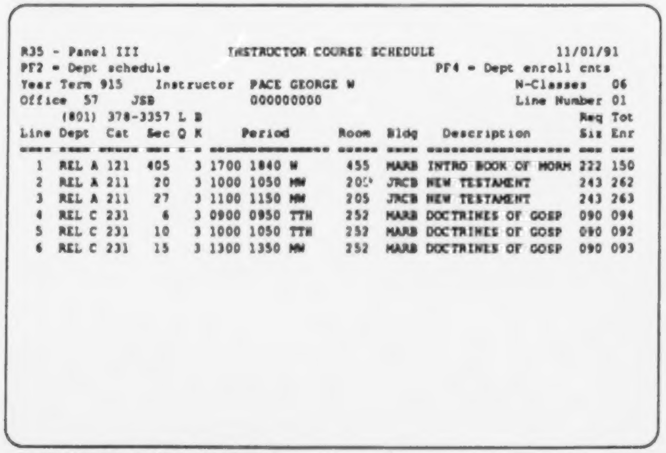


```
R36 - Panel II       ROOM SCHEDULED BY HOUR AND DAY                 11/01/91
PF2 = Room schedule                            PF5 = Instructor's sched chart
Year Term  915       Building  SWKT  FHS73 Dept Pref
                     Room       250   296  Capacity

Hr |      Monday      |     Tuesday     |   Wednesday    | Thursday      |     Friday     |
07          ...               ...              ...             ...              ...
08  ECON  110   001 PSYCH 111   001 ECON  110   001 PSYCH 111   001 ECON  110   001
09  FAMSC 210   003 PL SC 110   001 FAMSC 210   003 PL SC 110   001 FAMSC 210   003
10  FAMSC 210   004 PL SC 110   001 FAMSC 210   004 PL SC 110   001 FAMSC 210   004
11  SOC   111   001       ...       SOC   111   001 ME EN 291R 001 SOC   111   001
12  PSYCH 111   003 TH F  117   001 PSYCH 111   003       ...       PSYCH 111   003
13  FAMSC 210   006 TH F  117   001 FAMSC 210   006       ...       FAMSC 210   006
14  ECON  110   005 TH F  117   001 ECON  110   005       ...       ECON  110   005
15          ...               ...              ...             ...              ...
16          ...               ...              ...             ...              ...
17          ...               ...              ...             ...              ...
18          ...               ...              ...             ...              ...
19          ...               ...              ...             ...              ...
20          ...               ...              ...             ...              ...
21          ...               ...              ...             ...              ...
22          ...               ...              ...             ...              ...
```

ROOM SCHEDULE BY HOUR AND DAY
Charts the classroom schedule by hour and day.
Enter year term, building and room number.

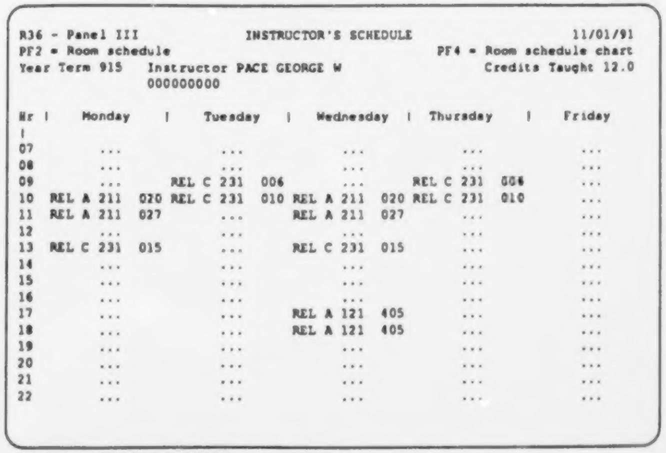
C



```
R35 - Panel III            INSTRUCTOR COURSE SCHEDULE              11/01/91
PF2 = Dept schedule                                    PF4 = Dept enroll cnts
Year Term 915      Instructor  PACE GEORGE W                      N-Classes   06
Office  57     JSB             000000000                          Line Number 01
     (801) 378-3357 L B                                                    Req Tot
Line Dept   Cat   Sec Q K        Period         Room  Bldg   Description      Siz Enr
==== ===== ===== === = = ================== ===== ==== ================== === ===
  1  REL A 121   405   3 1700 1840 W         455  MARB INTRO BOOK OF MORM 222 150
  2  REL A 211    20   3 1000 1050 MW        205  JRCB NEW TESTAMENT      243 262
  3  REL A 211    27   3 1100 1150 MW        205  JRCB NEW TESTAMENT      243 263
  4  REL C 231     6   3 0900 0950 TTH       252  MARB DOCTRINES OF GOSP  090 094
  5  REL C 231    10   3 1000 1050 TTH       252  MARB DOCTRINES OF GOSP  090 092
  6  REL C 231    15   3 1300 1350 MW        252  MARB DOCTRINES OF GOSP  090 093
```

INSTRUCTOR COURSE SCHEDULE
Lists instructor schedule and enrollment data by section.
Enter year term, name or social security number.

D



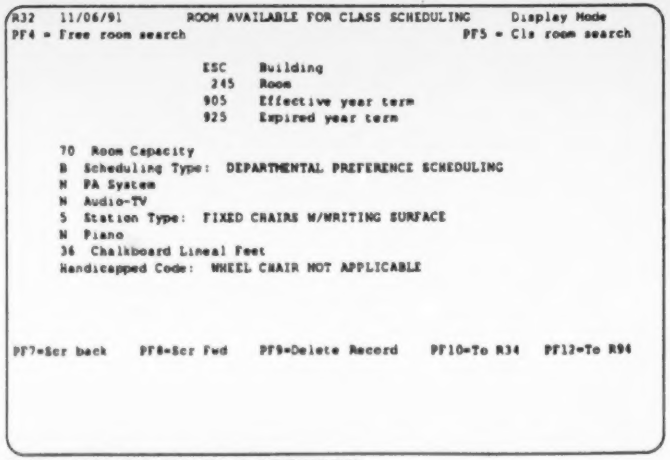
```
R36 - Panel III               INSTRUCTOR'S SCHEDULE                   11/01/91
PF2 = Room schedule                                    PF4 = Room schedule chart
Year Term 915   Instructor PACE GEORGE W                     Credits Taught 12.0
                000000000

Hr |     Monday      |    Tuesday      |   Wednesday    | Thursday      |    Friday
|
07         ...              ...              ...             ...              ...
08         ...              ...              ...             ...              ...
09         ...       REL C 231   006         ...       REL C 231   006        ...
10  REL A 211   020 REL C 231   010 REL A 211   020 REL C 231   010          ...
11  REL A 211   027         ...       REL A 211   027        ...              ...
12         ...              ...              ...             ...              ...
13  REL C 231   015         ...       REL C 231   015        ...              ...
14         ...              ...              ...             ...              ...
15         ...              ...              ...             ...              ...
16         ...              ...              ...             ...              ...
17         ...              ...       REL A 121   405        ...              ...
18         ...              ...       REL A 121   405        ...              ...
19         ...              ...              ...             ...              ...
20         ...              ...              ...             ...              ...
21         ...              ...              ...             ...              ...
22         ...              ...              ...             ...              ...
```

INSTRUCTOR'S SCHEDULE
Charts the instructor's teaching schedule by hour and day.
Enter year term, instructor name or social security number.

Figure 3

A



```
R32   11/06/91        ROOM AVAILABLE FOR CLASS SCHEDULING     Display Mode
PF4 = Free room search                                  PF5 = Cls room search

                        ESC    Building
                         245   Room
                        905    Effective year term
                        925    Expired year term

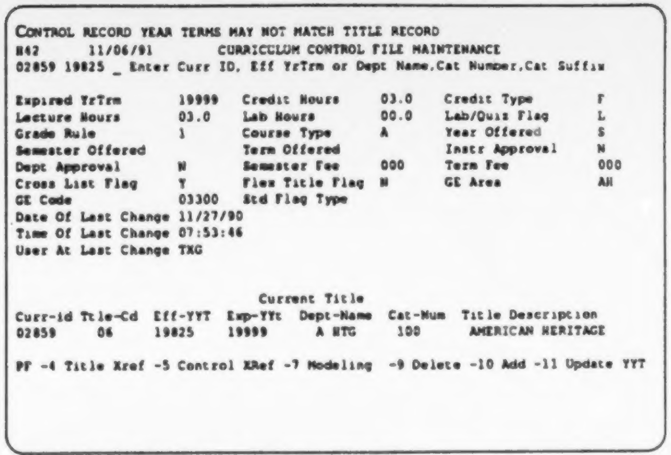
     70  Room Capacity
     B  Scheduling Type:  DEPARTMENTAL PREFERENCE SCHEDULING
     N  PA System
     N  Audio-TV
     5  Station Type:  FIXED CHAIRS W/WRITING SURFACE
     N  Piano
     36  Chalkboard Lineal Feet
     Handicapped Code:  WHEEL CHAIR NOT APPLICABLE



PF7=Scr back    PF8=Scr Fwd    PF9=Delete Record    PF10=To R34   PF12=To R94
```

ROOM AVAILABLE FOR CLASS SCHEDULING
Indentifies classrooms and characteristic.
Enter building and room number.

B



```
CONTROL RECORD YEAR TERMS MAY NOT MATCH TITLE RECORD
R42      11/06/91          CURRICULUM CONTROL FILE MAINTENANCE
02859 19825 _ Enter Curr ID, Eff YrTrm or Dept Name,Cat Number,Cat Suffix

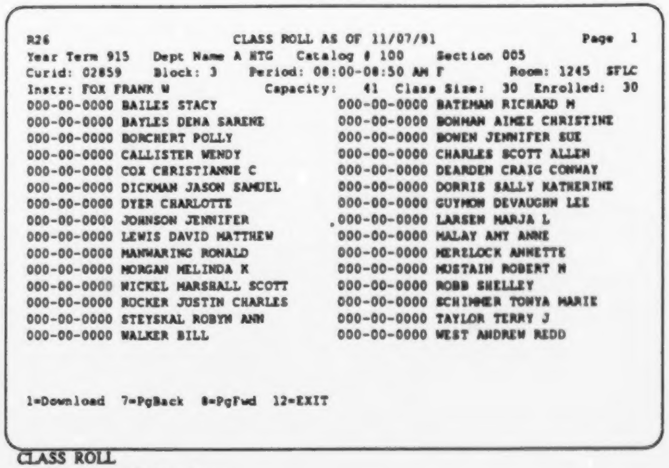
Expired YrTrm         19999   Credit Hours      03.0    Credit Type         F
Lecture Hours         03.0    Lab Hours         00.0    Lab/Quiz Flag       L
Grade Rule            1       Course Type       A       Year Offered        S
Semester Offered              Term Offered              Instr Approval      N
Dept Approval         N       Semester Fee      000     Term Fee            000
Cross List Flag       Y       Flex Title Flag   N       GE Area             AH
GE Code               03300   Std Flag Type
Date Of Last Change 11/27/90
Time Of Last Change 07:53:46
User At Last Change TXG


                             Current Title
Curr-id Ttle-Cd  Eff-YYT  Exp-YYt  Dept-Name  Cat-Num  Title Description
02859     06     19825    19999      A HTG      100      AMERICAN HERITAGE

PF -4 Title Xref -5 Control XRef -7 Modeling  -9 Delete -10 Add -11 Update YYT
```

CURRICULUM CONTROL FILE MAINTENANCE
Displays course description.
Enter department name, catalog number, or ID number.

C



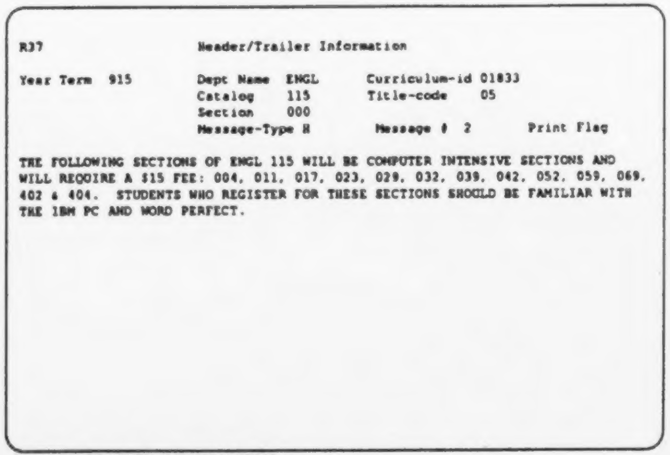
```
R26                          CLASS ROLL AS OF 11/07/91                  Page  1
Year Term 915   Dept Name A HTG   Catalog # 100     Section 005
Curid: 02859    Block: 3    Period: 08:00-08:50 AM F         Room: 1245  SFLC
Instr: FOX FRANK W              Capacity:    41  Class Size:   30  Enrolled:  30
000-00-0000 BAILES STACY                  000-00-0000 BATEMAN RICHARD M
000-00-0000 BAYLES DENA SARENE            000-00-0000 BONHAM AIMEE CHRISTINE
000-00-0000 BORCHERT POLLY                000-00-0000 BOWEN JENNIFER SUE
000-00-0000 CALLISTER WENDY               000-00-0000 CHARLES SCOTT ALLEN
000-00-0000 COX CHRISTIANNE C             000-00-0000 DEARDEN CRAIG CONWAY
000-00-0000 DICKMAN JASON SAMUEL          000-00-0000 DORRIS SALLY KATHERINE
000-00-0000 DYER CHARLOTTE                000-00-0000 GUYMON DEVAUGHN LEE
000-00-0000 JOHNSON JENNIFER             .000-00-0000 LARSEN MARJA L
000-00-0000 LEWIS DAVID MATTHEW           000-00-0000 MALAY AMY ANNE
000-00-0000 MANWARING RONALD              000-00-0000 MERZLOCK ANNETTE
000-00-0000 MORGAN MELINDA K              000-00-0000 MUSTAIN ROBERT M
000-00-0000 NICKEL MARSHALL SCOTT         000-00-0000 ROBB SHELLEY
000-00-0000 ROCKER JUSTIN CHARLES         000-00-0000 SCHIMMER TONYA MARIE
000-00-0000 STEYSKAL ROBYN ANN            000-00-0000 TAYLOR TERRY J
000-00-0000 WALKER BILL                   000-00-0000 WEST ANDREW REDD



1=Download  7=PgBack  8=PgFwd  12=EXIT
```

CLASS ROLL
Lists students enrolled by class.
Enter department name, catalog number and section number.

D



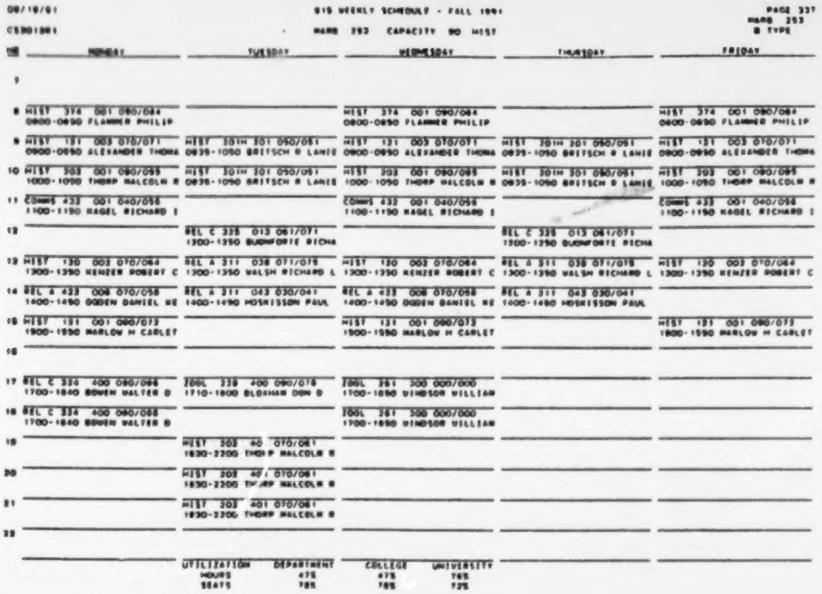
```
R37                    Header/Trailer Information

Year Term  915         Dept Name  ENGL       Curriculum-id 01833
                       Catalog    115        Title-code     05
                       Section    000
                       Message-Type H         Message #  2        Print Flag

THE FOLLOWING SECTIONS OF ENGL 115 WILL BE COMPUTER INTENSIVE SECTIONS AND
WILL REQUIRE A $15 FEE: 004, 011, 017, 023, 029, 032, 039, 042, 052, 059, 069,
402 & 404.  STUDENTS WHO REGISTER FOR THESE SECTIONS SHOULD BE FAMILIAR WITH
THE IBM PC AND WORD PERFECT.
```

HEADER/TRAILER INFORMATION
Displays statements for class schedule insert.
Enter department name, catalog number and section number.

Figure 4



```
08/19/91                              815 WEEKLY SCHEDULE - FALL 1991                                    PAGE 337
C5301381                            . HARB 253   CAPACITY  90  HIST                                      HARB  253
                                                                                                          B TYPE
HR ______MONDAY______  _____TUESDAY______  ____WEDNESDAY_____  _____THURSDAY_____  ______FRIDAY______

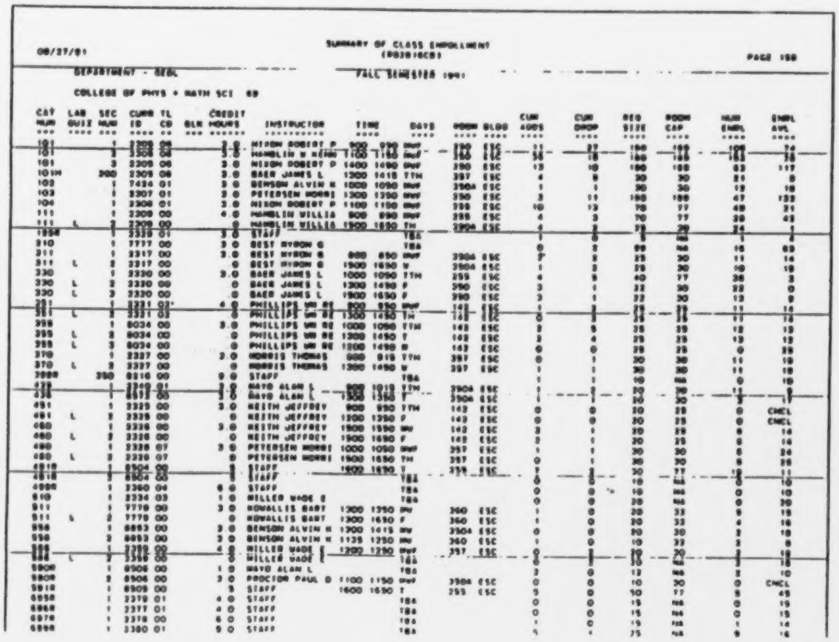
 7

 8 HIST  374  001 080/084                     HIST  374  001 080/084                     HIST  374  001 080/084
   0800-0850 FLAMMER PHILIP                   0800-0850 FLAMMER PHILIP                   0800-0850 FLAMMER PHILIP
 9 HIST  131  003 070/071  HIST  301H 301 050/051  HIST  131  003 070/071  HIST  301H 301 050/051  HIST  131  003 070/071
   0900-0950 ALEXANDER THOMA 0935-1050 BRITSCH R LANIE 0900-0950 ALEXANDER THOMA 0935-1050 BRITSCH R LANIE 0900-0950 ALEXANDER THOMA
10 HIST  303  001 080/085  HIST  301H 301 050/051  HIST  303  001 080/085  HIST  301H 301 050/051  HIST  303  001 080/085
   1000-1050 THORP MALCOLM R 0935-1050 BRITSCH R LANIE 1000-1050 THORP MALCOLM R 0935-1050 BRITSCH R LANIE 1000-1050 THORP MALCOLM R
11 COMMS 433  001 040/056                     COMMS 433  001 040/056                     COMMS 433  001 040/056
   1100-1150 NAGEL RICHARD I                  1100-1150 NAGEL RICHARD I                  1100-1150 NAGEL RICHARD I
12                         REL C 325  013 061/071                     REL C 325  013 061/071
                           1200-1250 BUONFORTE RICHA                  1200-1250 BUONFORTE RICHA
13 HIST  130  003 070/064  REL A 311  038 071/075  HIST  130  003 070/064  REL A 311  038 071/075  HIST  130  003 070/064
   1300-1350 KENZER ROBERT C 1300-1350 WALSH RICHARD L 1300-1350 KENZER ROBERT C 1300-1350 WALSH RICHARD L 1300-1350 KENZER ROBERT C
14 REL A 423  008 070/058  REL A 311  043 030/041  REL A 423  008 070/058  REL A 311  043 030/041
   1400-1450 OGDEN DANIEL KE 1400-1450 HOSKISSON PAUL 1400-1450 OGDEN DANIEL KE 1400-1450 HOSKISSON PAUL
15 HIST  131  001 080/073                     HIST  131  001 080/073                     HIST  131  001 080/073
   1500-1550 MARLOW H CARLET                  1500-1550 MARLOW H CARLET                  1500-1550 MARLOW H CARLET
16

17 REL C 334  400 080/086  ZOOL  338  400 090/078  ZOOL  361  300 000/000
   1700-1840 BOWEN WALTER D  1710-1800 BLOXHAM DON D  1700-1850 WINDSOR WILLIAM
18 REL C 334  400 080/088                     ZOOL  361  300 000/000
   1700-1840 BOWEN WALTER D                   1700-1850 WINDSOR WILLIAM
19                         HIST  303  401 070/081
                           1830-2200 THORP MALCOLM R
20                         HIST  303  401 070/081
                           1830-2200 THORP MALCOLM R
21                         HIST  303  401 070/081
                           1830-2200 THORP MALCOLM R
22

                           UTILIZATION   DEPARTMENT    COLLEGE    UNIVERSITY
                              HOURS           47%        47%         76%
                              SEATS           78%        78%         72%
```

Figure 5



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08/27/91                              SUMMARY OF CLASS ENROLLMENT                                  PAGE 198
                                             (P0301SCB)
      DEPARTMENT - GEOL                    FALL SEMESTER 1991

      COLLEGE OF PHYS + MATH SCI  69

CAT  LAB  SEC  CURR TL       CREDIT                                                    CUM    CUM    REQ   ROOM    NUM   ENRL
NUM  QUIZ NUM  ID   CD  BLK  HOURS   INSTRUCTOR    TIME       DAYS  ROOM BLDG   ADDS   DROP   SIZE  CAP     ENRL  AVL
```

Accountancy and Information Systems

Figure 6

ACC	200		8961	PRIN OF ACCOUNTING	3.0				
001	8961	S	10:00–11:20 am		MTWTH	2	260	TNRB	STAFF

ACC 201 INDEPENDENT STUDY ALSO (206 HCEB, FEE REQUIRED)

ACC	201		0011	PRIN OF ACCOUNTING	3.0				
001	0011	S	10:00–11:20 am		MTWTH	2	230	TNRB	DEPPE L A

ACC 202 INDEPENDENT STUDY ALSO (206 HCEB, FEE REQUIRED)

ACC	202		0012	PRIN OF ACCOUNTING	3.0				
001	0012	S	12:00–1:20 pm		MTWTH	2	260	TNRB	HARDY J W
ACC	341		8966	BUS LAW IN ENVIRON	2.0				
001	8966	S	8:00–9:50 am		MWF	2	260	TNRB	STAFF
ACC	599R		2997	ACCTG INTERNSHIP	V 3.0				
370	2997	S			TBA	2			HARDY J W
380	2997	S			TBA	2			HARDY J W

Agronomy and Horticulture

AGHRT	399R		0168	COOP ED	V 4.0				
350	0166	S			TBA	2			ELLSWORTH D D
379	0166	S			TBA	2			ELLSWORTH D D
AGHRT	497R		0176	SPECIAL PROBLEMS	V 2.0				
001	0176	S			TBA	2			STAFF
AGHRT	596R		0184	ADVANCED TOPICS	V 2.0				
001	0184	S			TBA	2			STAFF
AGHRT	697R		0188	RESEARCH	V 9.0				
001	0188	S			TBA	2			STAFF
AGHRT	698R		0189	MASTER'S PROJECT	V 6.0				
001	0189	S			TBA	2			STAFF
AGHRT	699R		5969	MASTER'S THESIS	V 9.0				
001	5969	S			TBA	2			STAFF

American Heritage

TO ADD SECTIONS 1 THROUGH 8 - CHOOSE THE LAB SECTION THAT YOU WISH TO ATTEND. REGISTERING FOR THE LAB WILL AUTOMATICALLY REGISTER YOU FOR THE LECTURE AS WELL. THE LAB IS LISTED ON THE FIRST LINE AND THE LECTURE DIRECTLY BELOW IT.

A HTG 100 INDEPENDENT STUDY ALSO (206 HCEB, FEE REQUIRED)

A HTG	100		2859	AMERICAN HERITAGE	3.0	AH			
001	2859	S	8:00–9:50 am		TH	2	3241	SFLC	BRADLEY M S
			2:00–3:50 pm		MW	2	250	SWKT	
002	2859	S	10:00–11:50 am		TH	2	3241	SFLC	BRADLEY M S
			2:00–3:50 pm		MW	2	250	SWKT	
003	2859	S	12:00–1:50 pm		TH	2	3241	SFLC	BRADLEY M S
			2:00–3:50 pm		MW	2	250	SWKT	
004	2859	S	2:00–3:50 pm		TH	2	1125	SFLC	BRADLEY M S
			2:00–3:50 pm		MW	2	250	SWKT	
005	2859	S	2:00–3:50 pm		TH	2	3208	SFLC	BRADLEY M S
			2:00–3:50 pm		MW	2	250	SWKT	
006	2859	S	8:00–9:50 am		F	2	1121	SFLC	BRADLEY M S
			2:00–3:50 pm		MW	2	250	SWKT	
007	2859	S	10:00–11:50 am		F	2	1125	SFLC	BRADLEY M S
			2:00–3:50 pm		MW	2	250	SWKT	
008	2859	S	12:00–1:50 pm		F	2	2320B	SFLC	BRADLEY M S
			2:00–3:50 pm		MW	2	250	SWKT	

American Sign Language

ASL	101		7742	CONVERSATION ASL	4.0				
400	7742	S	2:00–4:00 pm		DAILY	2	1121	SFLC	STAFF
ASL	102		7743	INTERMEDIATE ASL	4.0				
400	7743	S	2:00–4:00 pm		DAILY	2	2320B	SFLC	STAFF
ASL	201		7746	ADV ASL GRAMMAR	4.0				
400	7746	S	2:00–4:00 pm		DAILY	2	2031	JKHB	STAFF
ASL	301		7747	ASL CULTURE	3.0	FL			
400	7747	S	3:00–4:30 pm		MW	2	2036	JKHB	STAFF

37th Annual College and University
Computer Users Conference

"Discover New Worlds With Technology"

T2-2

Seminole ACCESS: Boldly Going Where No University Has Gone Before

Bill Norwood
Thomas James
Florida State University

Seminole ACCESS: Boldly Going Where No University Has Gone Before

Bill R. Norwood
Director, Seminole ACCESS Center
Florida State University

Thomas G. James
Director, Administrative Information Systems
Florida State University

Introduction

It has been almost two years since we described an idea for a debit card system at the CUMREC'90 conference in Buffalo.[1] At that time the project was nothing more than a pilot of some of the billing processes and systems, and the final approval to proceed with the addition of debit card features had not yet been made. Since then the concept of tailoring a private label bank card to the unique needs of a university campus has acquired a name, Seminole ACCESS, has had its debit card features thoroughly tested[2], and has matured sufficiently to replace the existing ID card. Thus, in February 1992 the process of re-carding the student body began.

In a way the experience of working on the Seminole ACCESS project is analogous to the mission of *Star Trek:* To seek out new worlds, and boldly go where no university has gone before. It seems that about every month or so another use of the ACCESS card occurs to someone, opening new worlds to explore and new problems to solve. Yet, what has been accomplished with the ACCESS card at FSU is not based on new technology, but on the combining or re-engineering of multiple existing technologies to solve current implementation problems.

In this paper our intent is to provide a brief update on the function and unique features of the Seminole ACCESS card, describe the system used to produce the card which became operational in February 1992, and illustrate how the technology was adapted to provide a long-distance calling card to students.

The ACCESSible Campus

To illustrate what we mean by ACCESS, consider the following scenario: After receiving his financial aid, John Student hurries to the campus bookstore to buy his books. He then drops by the Cashier's office and pays his tuition, housing, and an overdue traffic fine from last semester. On his way into the Biology class in the lecture hall he registers his attendance. After class John purchases a Coke and a package of crackers, checks out a library book, copies class notes for a friend, works out at the natatorium, does some laundry, buys gas for the BMW at the corner AMOCO station, and purchases steaks at the Westwood Publix for grilling at his girl friend's apartment. Since some additional cash will be needed for the weekend, John drops by the First Florida ATM on his way to the cookout. After dinner John parks in the limited access lot, and upon entering his dormitory receives an emergency message on the LCD display on the front door. After jotting down the telephone number in the message John makes a long-distance call from the pay telephone in the lobby.

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[1] Thomas G. James & Bill R. Norwood, "Bank Card Processing in a University Environment," paper presented at CUMREC'90, Buffalo, N.Y., May 1990.

[2] Thomas G. James & Bill R. Norwood, "Turning a Private Label Bank Card into a Multi-function Campus ID Card," *CAUSE/EFFECT*, Vol. 14 No. 2 Summer 1991, pp. 40-46.

In this scenario the student has been able to use an ACCESS card for all of the activities mentioned except two. We haven't figured out how to use the ACCESS card to cook the steaks or drive the BMW! Realizing the full potential of the ACCESS card is a never ending quest. Like much of the technology available today, we are only limited by our imagination. The vision of ACCESS is a vision of a single card integrating all aspects of life on campus for a student. One single card that can streamline administrative processes, such as paying fees or receiving financial aid, as well as open dormitory doors, give emergency messages, dispense cash, and be accepted throughout the community.

The technologies responsible for enabling the integration of services we have described are not new. Rather, they have simply been combined in a unique way to accomplish the desired results. The principal existing technologies include CR80 plastic cards, American Banking Association (ABA) encoded magnetic stripes, proprietary vending stripes, a mature bank card processing system, and a variety of enabling technologies such as intelligent readers, security systems, etc. Throw in the ability to digitize and print photographs on a CR80 card, and you have the Seminole ACCESS card.

It is the encoded magnetic stripe using a sixteen digit private label account number and the vending stripe that enable the card to provide access. As illustrated in Figure 1, there are basically two *financial* functions of the card, one that interfaces to a financial institution through the standard magnetic stripe, and one that interfaces to campus functions through the vending stripe.

The Seminole ACCESS card provides access to the following services/activities today:

ACCESS Center Services

- Receive prepayments (electronically transmitted)
- Dispense emergency cash (no PIN required)
- Issue new ACCESS cards (on-site)
- Replace bad ACCESS cards (on-site)
- Issue PIN (Bank Center mails)
- Issue monthly statements (Bank Center mails)
- Collect long distance and cable TV charges for Telecommunications Office
- Answer questions
- Emergency contact (through POS system)

Other Campus Activities

- Security access control to facilities
- Card holder status verification
- Access control emergency messaging
- Self-inquiry terminals (determine amount owed, print schedules, etc.)
- Picture ID card
- Check cashing
- Access control to events
- Check out library books

Campus-wide Services

- Pay for athletic fees, housing fees, Health Center charges, meal plan, individual meals, computer store purchases, athletic ticket purchases, books, accounts receivable, tuition, pre-payment authorization for tuition & AR, sports clothes, concert tickets, groceries, copier service, department charges, golf course usage, gifts, parking permits, parking tickets, canoeing/skiing trips, cokes, washers/dryers, and vending machines.
- Withdraw funds from on-campus ATM.

Off-campus Services

- Card accepted at over 200 local merchants such as bookstores, sporting goods stores, drug stores, health and beauty stores, restaurants, auto parts stores, gas stations, car dealers, supermarkets, and city-wide ATM machines.

State-wide Activities

- Publix supermarkets (via debit card reader)
- Publix *Presto* ATM network
- First Florida Bank *Max* ATM network

Nation-wide Services

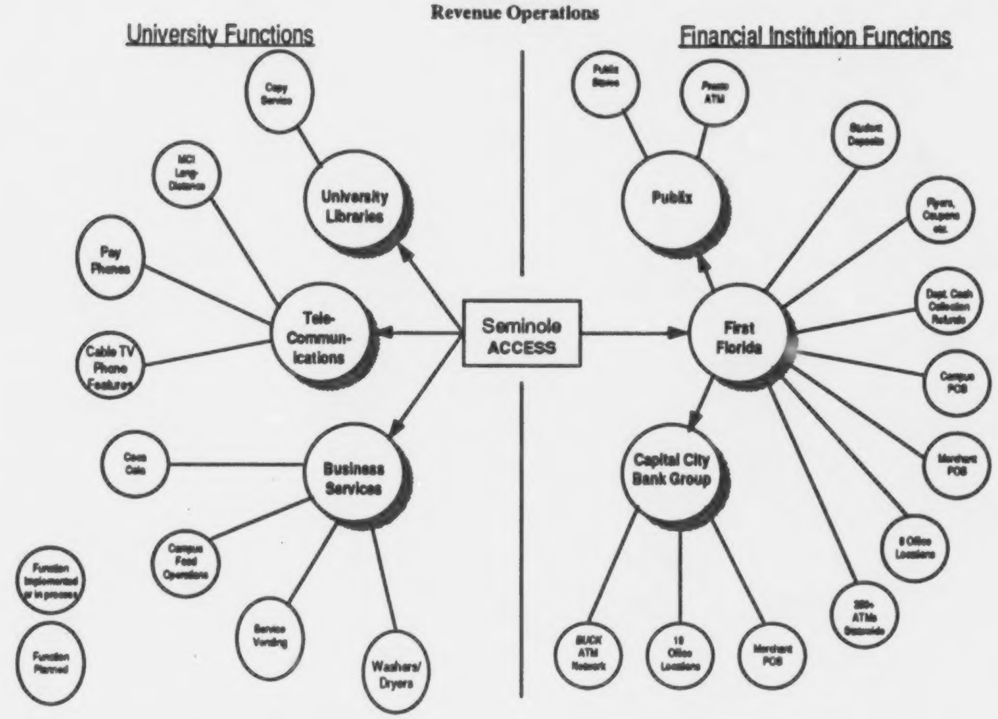
- MCI calling card

Future Services

- Automated tuition payment via voice response system
- Electronic distribution of financial aid.
- City of Tallahassee transit system

Figure 1

Seminole Access
Revenue Operations


University Functions
Financial Institution Functions
Seminole ACCESS
University Libraries
Copy Service
Tele-Communications
MCI Long Distance
Pay Phones
Cable TV Phone Features
Business Services
Coca Cola
Campus Food Operations
Service Vending
Washers/ Dryers
Function Implemented or in process
Function Planned
Publix
Publix Stores
Presto ATM
First Florida
Student Deposits
Flyers, Coupons etc.
Dept. Cash Collection Refunds
Campus POS
Merchant POS
8 Office Locations
200+ ATMs Statewide
Capital City Bank Group
BUCK ATM Network
10 Office Locations
Merchant POS

University ID Replacement

Besides issues related to services accessible via the Seminole ACCESS card, a major concern is the physical construction and design of the card. In order to be an effective replacement for the existing University ID card, the Seminole ACCESS card had to be easy to issue and must contain a photograph. In our earlier pilot for ACCESS, students in our sample received a plastic CR80 card that was embossed and encoded at the charge card processing center in Tampa, FL. No photograph was provided on the original test cards. Lost or damaged ACCESS cards had to be re-recorded; a process that could take a week or more. Further compounding the situation was the requirement to add the student's image to the ACCESS card, which would be difficult since the cards were made off-site. If this problem could not be solved, the ACCESS program would not be successful.

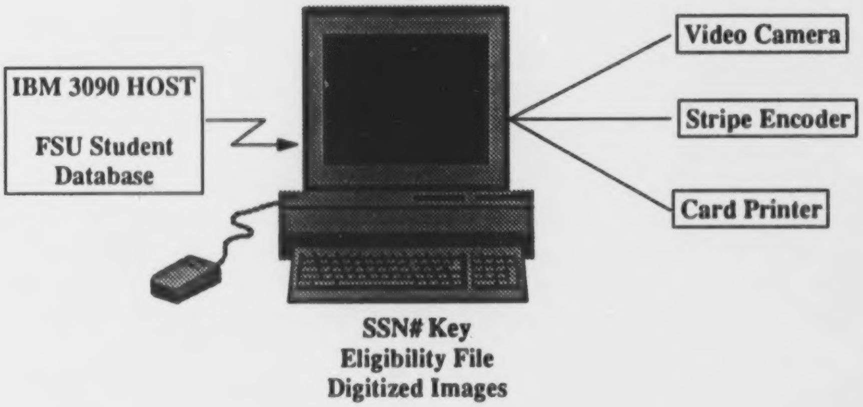
Fortunately, we were able to find a solution. DataCard Corporation had been working with FSU over the past two years to develop new ID card equipment. Because of their involvement in the banking industry, DataCard ID card equipment used CR80 (credit card) stock to print on, not film. Since we were working with banking technology, credit card readers and ATMs, an ID card made from non-laminated, credit card stock was a requirement.

These points are important for several reasons: 1) banking technology is very exacting in tolerances for card thickness, 2) laminated cards are not consistent in thickness and use "pockets" for the pictures, and 3) film based systems are slow. Another real advantage of using the credit card stock is the cost. Blank credit card stock costs about $.20 compared to Polaroid film which costs $1.20/picture or Hitachi film at $1.75/picture. With ribbon costs added to the cost of the credit card stock the finished ID card now has less than $.35 in material cost.

Perhaps even more important is the operational design of the DataCard system. Driven by data-base software, student, faculty and staff data is downloaded to a PC based system having four basic components: 1) a 80386 PC for processing and storing data, 2) video camera for creating images, 3) plastic card printer, and 4) a magnetic stripe encoder. One additional encoder will be added in the future for encoding the vending stripe.

Figure 2

DataCard ID Card System



Data downloaded to this system includes several key data elements such as all of the information required for encoding the ABA stripe on the ID card. The sixteen digit account number, offsets for the calculation of pin numbers in ATMs, and card expiration dates are all preassigned to the downloaded records. This information was originally embossed and encoded on the pilot cards produced by the charge card center.

Another key element included in the downloaded data is the student's library patron number. The patron number is a derivative of the student's 16 digit ACCESS account number and is not encoded in the ABA stripe on the card. It is printed on the front of the card for visual reference and read into the library system using a conversion algorithm programmed into a ScanTech magnetic stripe reader on each library terminal.

The DataCard system gives us the ability to create our cards on-site, as well as the ability to create digitized repositories of card-holder images that can be copied and transported to other systems. These systems can provide reference to images of students for offices such as campus security, the Registrar's office, and the testing center. Over 40,000 images will fit on one 200MB hard drive.

Long-Distance Calling Card

FSU recently established a relationship with MCI to provide a student long-distance calling card. Naturally, our desire was to combine the calling card with the Seminole ACCESS card. Because the ACCESS card uses a private-label account number, we could not convince the telephone companies to use our card and account number in their system. We wondered, however, if it would be possible to assign each student their own calling card number and authorization, and simply print that information on the ACCESS card instead of issuing a separate long-distance calling card. The problem, of course, was that the front of the ACCESS card was already full of information.

While running test cards through the DataCard printer, we noticed that it did not make a difference which side of the card was up--it would print on either surface. If we could print on both sides of the card, why not print the long distance calling card number and authorization code on the back of the card? We discussed this with MCI and DataCard and after several weeks of testing, had a procedure set up where calling card numbers were printed on the back of the ACCESS Card. The process takes an additional 30 seconds of processing time and less than $.10 in ribbon cost.

This particular discovery is important for two reasons, the student has one less card to carry, and the university is creating an ongoing revenue source. The on-going revenue source can be significant. If, for example, FSU issues 20,000 ACCESS Cards, 20,000 potentially active calling cards are issued as well. If each of card holders make an average of five dollars worth of long distance calls per month, the University will recognize an income of around $10,000 per month. Since the calling card number belongs to the holder for life, the university will continue receiving the revenue long after the student graduates.

In these days of budget reductions, which in Florida comes in waves, income sources are even more critical. ACCESS will pay for itself and generate revenue for the university through programs like the calling card/ID card combination. In addition, significant savings in resources and dollars currently committed to activities such as fee payment and financial aid distribution can be realized.

Conclusion

Even as we proceed to implement the Seminole ACCESS card new uses are being discovered and worked into the overall plan. The ability to add the functionality of a calling card to the ACCESS card is a tribute to the system's flexibility. We have demonstrated the ability to deal effectively with vendors of products and services outside the university environment.

In a developmental effort critical to the future of the Seminole ACCESS program we have tested the process of transferring financial aid directly to the student's ACCESS account, a process which is projected to save the University between $75,000 and $100,000 in distribution costs annually. The design work is being completed for the batch system to feed this application, and programming is expected to be completed for testing in the summer of 1992. It is the relationship between the student and the financial institution through the ACCESS card that will allow these types of financial transactions to be streamlined.

Thus, as a financial management tool for the holder and for the University, and as a provider of non-financial services to make life on campus more convenient and enjoyable for students, the Seminole ACCESS card is in a world by itself.

As we go forward with even more development, we are convinced that other "worlds" in the university environment will be discovered that are suitable for an ACCESS card solution. We believe the Seminole ACCESS card system will enable us to continue to find new ways to provide basic and innovated services to students, as well as revenue opportunities and cost savings for the University.

37th Annual College and University
Computer Users Conference

"Discover New Worlds With Technology"

T2-3

SPEEDE Simplified: The User Perspective

Donald Wermers
Thomas Scott
Laura Patterson
University of Wisconsin

SPEEDE SIMPLIFIED:
THE USER PERSPECTIVE

A Paper Presented at the
College and University Machine
Records Annual Meeting

By:

Donald J. Wermers
Registrar
University of Wisconsin-Madison

Laura McCain Patterson
Registrar
University of Wisconsin-Eau Claire

Thomas J. Scott
Special Assistant to Director, ADP
University of Wisconsin-Madison

May 4, 1992 Miami, Florida

SPEEDE SIMPLIFIED: THE USER PERSPECTIVE

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U. of Wisconsin-Madison

Introduction: Closing the Technology Gap

Recent publications stress the need for institutions to vigorously and creatively apply electronic technology to the many processes related to serving students and staff in the academic environment (Evert, 1990; Jones, 1990; Lonabocker, 1990). The real beginnings of using this technology in higher education during the 1960's (key-punch cards, sorters etc.) evolved into real progress in the 1970's as data were entered and accessed directly on line with staffed terminals. Real breakthroughs occurred in the 1980's with touchtone telephone/voice response applications, distributed processing, FAX, etc. Higher education is now poised to take advantage of the real opportunities of the 1990's, i. e. to catch up with available and emerging technologies by increasing the applications of these tools to our many daily processes.

A partial listing of the many processes that are performed routinely in the student academic support service areas of most colleges and universities is shown in the right column of Figure 1 below. The left column lists the powerful electronic tools available for use by higher education. Although the processes in the right column may remain relatively constant, the number and types of electronic tools in the left column will grow with increasing rapidity in the immediate and continuing future.

Figure 1: ***Applications of Electronic Technologies to Processes in Higher Education***

ELECTRONIC TECHNOLOGY TOOLS

- ATM'S
- AUTOMATED MULTI-FUNCTION ID'S
- COMPUTER TERMINALS:
  - ✓ "DUMB"
  - ✓ LAPTOPS
  - ✓ NOTEBOOKS
  - ✓ PC'S (SMART)
  - ✓ PALMTOPS
  - ✓ TOUCHSCREEN
- **ELECTRONIC DATA INTERCHANGE (EDI)**
- FACSIMILE (FAX)
- LAN'S
- LASER IMAGE
- MAINFRAMES
- TOUCHTONE TELEPHONE WITH VOICE RESPONSE
- ETC.

Applied To:

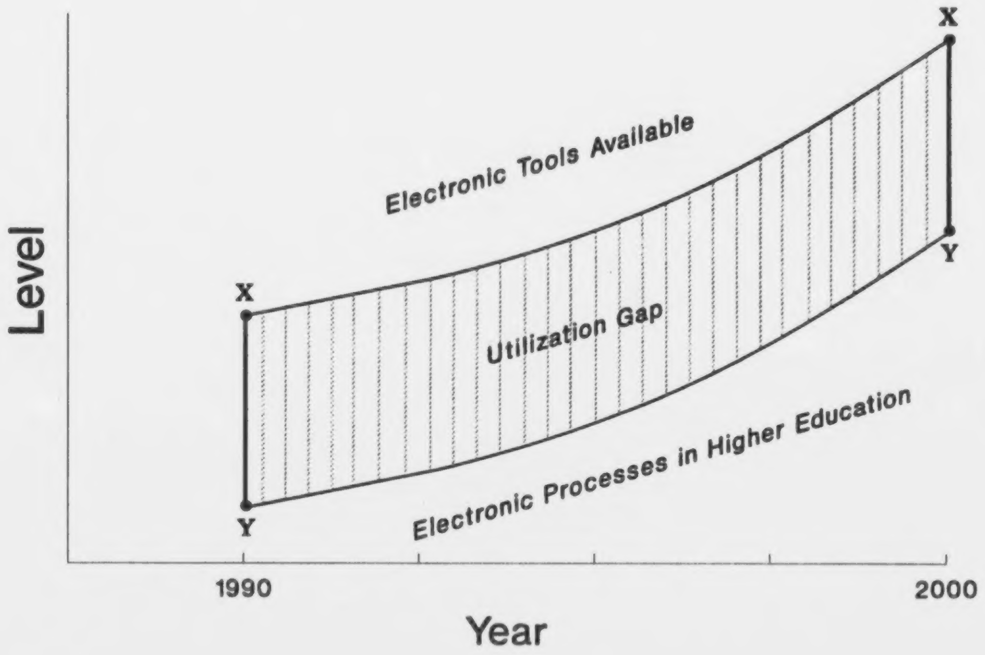
HIGHER EDUCATION PROCESSES

- APPLICATIONS FOR AND STATUS OF:
  - ✓ ADMISSIONS
  - ✓ FINANCIAL AID
  - ✓ HOUSING
- ADVISEMENT/ DEGREE SUMMARIES
- COURSE EQUIVALENCY EVALUATIONS
- GRADE TRANSMISSION/ENTRY/REPORTING
- FEE ASSESSMENT/PAYMENT
- FINANCIAL AID DISTRIBUTION
- ID CARDS
- NEW STUDENT ORIENTATION:
  - ✓ INFORMATION ABOUT
  - ✓ REGISTERING FOR
- RECORD ARCHIVING/FOLDERING
- REGISTRATION
- STUDENT ACCESS TO OWN DATA
- STUDENT FINANCIAL ACCOUNTS
- STUDENT ACCESS TO COURSE/SECTION AVAILABILITY
- TRANSCRIPT/CERTIFICATION REQUESTS
- **TRANSCRIPTS (SEND AND RECEIVE)**

Although certain institutions can be cited as rare exceptions, higher education in general is not keeping pace with technical developments as evidenced by the relatively small number of applications of these tools to routine daily processes. The difference between the technologies available and the way business is conducted in higher education may be referred to as the "electronic technology utilization gap". Figure 2 illustrates this concept.

Electronic technology tools available in the 1990's are represented at level X. The use of these tools in higher education is represented at level Y. The difference between X and Y represents the level of under-utilization of available technologies in supporting the academic mission of our institutions. Since the X and Y levels can not be quantified, these values are theoretically placed on the table for illustration purposes only. In reality, the difference between X and Y varies among individual institutions.

FIGURE 2: ***Electronic Technology Utilization Gap***



The challenge for education in the 1990's is to close this gap or, at the very least, keep the gap from widening as new technologies emerge in the years ahead. This challenge can only be met with more creative, more imaginative, and increasingly more effective strategies in implementing applications of these tools to routine daily processes. With each successful implementation, student service offices will be able to provide more timely and more accurate services to its many constituents (students, faculty, staff, and administrators) in more efficient and increasingly humane and user-friendly ways (Gawkoski et. al., 1990).

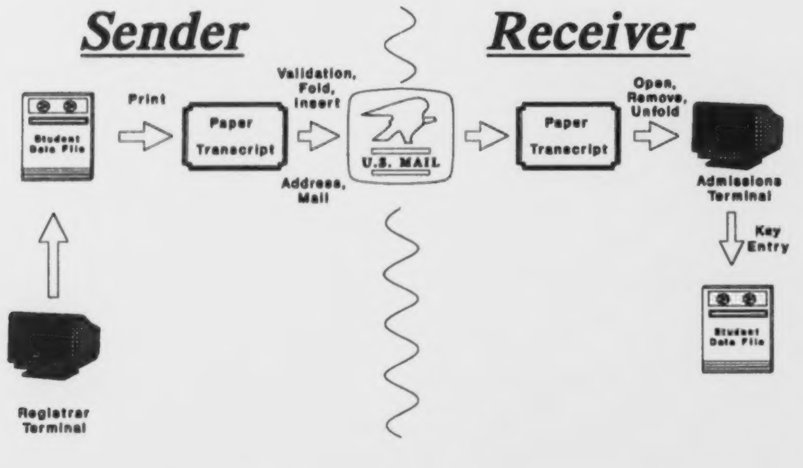
Out of this larger picture emerges one relatively simple application of existing technology--**ELECTRONIC DATA INTERCHANGE (EDI)**--to a routine daily process for registrar and admissions offices--**SENDING AND RECEIVING TRANSCRIPTS**. This concept has acquired a label--**SPEEDE**--which is the focus of this paper. Specifically, it will focus on what SPEEDE is; its benefits and concerns; current status of SPEEDE development, including a report of the Wisconsin project; and where it's headed.

What Is SPEEDE?

Before addressing SPEEDE, it is important to understand the EDI concept. In relation to transcripts, EDI is the interinstitutional exchange of academic documentation in structured machine-processible form. EDI can be viewed as a way of replacing methods of transmission such as mail, FAX, or in-person delivery with electronic transmission. "However, EDI is actually a way of replacing manual data entry with electronic data entry. The purpose of EDI is not to eliminate paper, but rather to eliminate processing delays and data entry" (Emmelhainz, p.4). Imagine EDI as the sender's computer talking directly to the receiver's computer. With transcripts, its a computer-to-computer exchange of academic information using a standardized data format.

That's EDI. Now, what is SPEEDE? Following are three attempts to answer this question. First, SPEEDE is an acronym for **Standardization of Postsecondary Education Electronic Data Exchange**. Although a simple answer, that collection of words describes SPEEDE surprisingly well and surprisingly accurately. A second answer suggests that SPEEDE is a transcript format--a standardized format developed by a task force of the American Association of Collegiate Registrars and Admissions Officers (AACRAO). A third definition alludes to SPEEDE as a method of transmitting and receiving transcripts. Yet, it is not just another version of the U.S. mail or FAX. SPEEDE is much more than that. Electronic transcript exchange is a powerful tool in and of itself (Carson, 1991). And, once installed, SPEEDE provides capabilities to assist offices that receive transcripts in ways that result in significant efficiencies in the admissions processes. All three answers are appropriate but incomplete as they do not convey adequately, neither individually nor collectively, the total concept of SPEEDE.

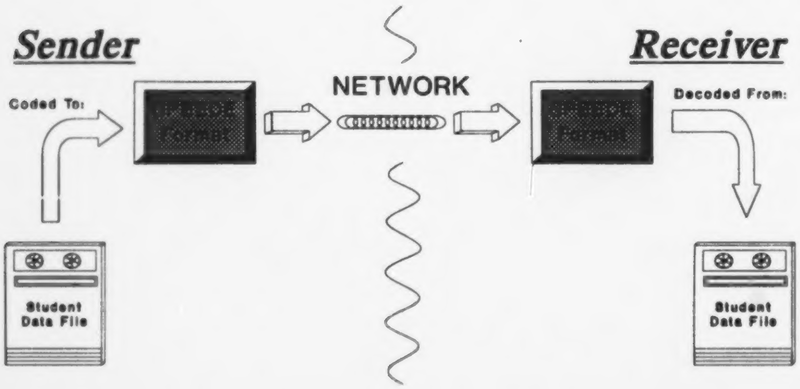
FIGURE 3: ***Traditional Processes Involved in Sending and Receiving Transcripts***



Comparing Figures 3 and 4 provides a better description of SPEEDE. The existing transcript process in an on-line environment is charted in Figure 3. The Registrar, in conjunction with computer analyst/programmers, designed the campus transcript format. The student data file was programmed to print the transcript in this prescribed format. The printed transcript is validated, folded, inserted, addressed, and mailed to the third party. The third party receives the printed transcript in the sender's format via U.S. mail. The receiver then opens, removes, unfolds, processes (according to the receiving institution's needs), and files. Transcript data entered on the receiving institution's file must, of course, be keyed and proofed.

Figure 4 illustrates a simplified version of SPEEDE--simplified, that is, from the perspective of users (registrars and admissions officers); not computer analysts/programmers. This simplified chart does not address the complexities involved in the analysis, design, and programming nor network transmission. The left half of Figure 4 shows that the sending institution, rather than preparing a printed transcript in its own format, extracts transcript data from the student record system data base and programs it into a different transcript format--the SPEEDE format. The transcript is not printed but prepared for (and transmitted over) electronic networks.

FIGURE 4: *SPEEDE--A Simplified Version*



The right side of Figure 4 shows that the transcript is received in the SPEEDE machine-processible format--not in the sending institution's format and not on paper. Upon receipt, the electronic SPEEDE transcript is reformatted by a conversion program to follow local data conventions, with appropriate edits during the conversion process. The reformatted data string is electronically entered directly to the receiver's student data file. The transcript data are now available in the receiving institution's electronic format without re-keying and is ready for further processing as needed.

From the perspective of the sender (i.e. transcript section of a registrar's office) and the receiver (i.e. admissions offices, professional school admissions services, state teacher certification offices, and employment/placement offices), **this is SPEEDE--the sending and receiving of a transcript in a standardized format via electronic transmission.** Figures 3 and 4 both show that the transcript process started with a terminal request to the sending institution's student data file. Both figures also show that transcript data were entered on the receiving institution's student data file. However, the labor intensiveness represented in the paper process (Figure 3) is absent from the SPEEDE process (Figure 4).

Why SPEEDE?

Why would institutions want to implement SPEEDE? The benefits from implementing SPEEDE include improved security, costs, accuracy, and speed. SPEEDE can also serve as a prototype for other EDI applications on campus. These benefits and the positive effect SPEEDE will have on service to students make it easy to understand why this is an application of technology that ought to be pursued.

Improved Security

First, SPEEDE will allow for improved security in sending and receiving transcripts. Protecting the integrity of the academic record is probably the highest priority of the registrar's office. The potential for falsification has never been greater than it is currently. Color copiers have destroyed the security of security transcript paper, and word processing and desk top publishing have made it quite easy to reproduce the characteristics that make an instititution's record unique. With electronic transmission of records and acknowledgement, the sender will know if the transcript has been received by the receiving institution. The acknowledgement will include information which should assure that the record was received in total and unaltered. Moreover, if an acknowledgement is received that another institution received a transcript which was not sent, immediate notification of the possibility of forgery can be transmitted. In addition, electronic transmission will require a more sophisticated tamperer than paper based transcripts currently do.

SPEEDE also allows for increased security by reducing the number of persons handling the record in order for it to get to its final destination. The number of clerical staff currently involved in printing, folding, stuffing, mailing, opening, and distributing transcripts will be reduced; moreover, the third party carrier, the U.S. mail, will be removed from sending and receiving transcripts.

Reduced Costs

A second benefit from SPEEDE implementation accrues in the potential for reduced costs. For the sending institution, transcript production requires a significant investment of personnel resources. Staff time is devoted to handling requests, printing transcripts, folding transcripts, stuffing the paper into envelopes, mailing, and maintaining a record of requests processed. Most registrar offices currently use expensive security paper for producing transcripts. The transcripts have a pre-printed signature, an additional expense, or are validated by special equipment in the registrar's office. The validation machines are expensive to maintain and replace. In addition, U.S. mail costs continue to increase. SPEEDE, when widely implemented, will eliminate many of the costs associated with current methods of transcript production.

For the receiving institution, the potential for reduced costs are even greater. With the data in standard format and the sending institution positively identified, bringing transfer data into the receiving institution's academic record will be a process requiring very little staff time. A comparison of the processes illustrated in Figures 3 and 4 show that SPEEDE will reduce the amount of staff time spent in opening the mail, date-stamping each piece, posting, and filing transcripts into applicants' files. The SPEEDE transcript will be entered into the receiving institution's data base, eliminating the re-keying of data, data entry errors, and the proof-reading of updates.

Improved Delivery of Service

Another significant benefit of SPEEDE is the improved delivery of service provided to students. Sending institutions can provide faster processing and delivery of transcripts, regardless of peak workloads and other demands on staff. It will be easier to respond to questions from students inquiring if a transcript has been sent as requested, because it will be possible to track not only that a transcript was sent, but that it was received. At receiving institutions, admission and registrar offices will be able to maintain logs of all transcripts received, something not possible in the current paper environment. Institutions will provide faster turnaround on transfer decisions because information will be posted to the receiving institution's record more quickly than currently possible. Institutions which receive transcripts electronically from high schools will be able to provide quicker turnaround in admissions decisions for new freshmen, also. Finally, the potential for reduced costs in transcript and processing may lead to reduced transcript charges to students.

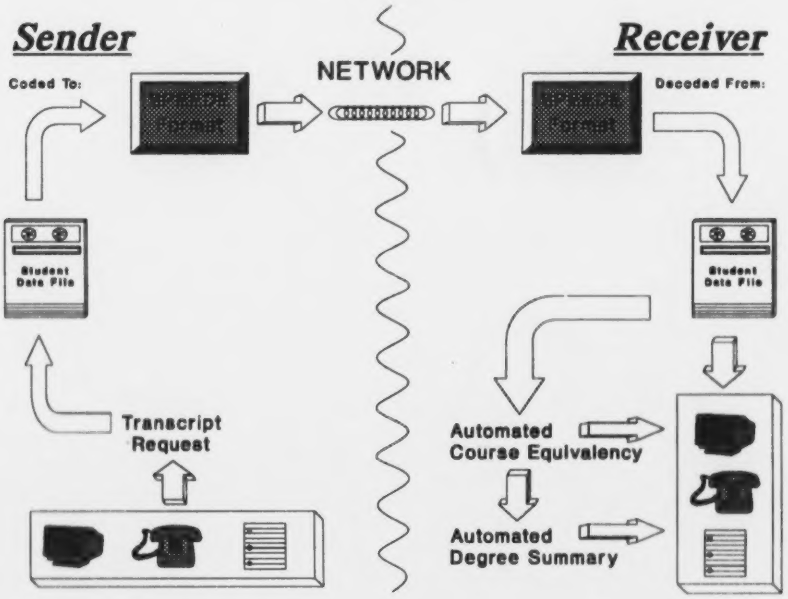
Prototype for Other EDI Applications

While the SPEEDE transcript is the initial EDI application in student services in higher education, there are a number of other potential applications. SPEEDE may be a way of encouraging other student service offices to pursue EDI technology. For example, most state and federal reporting is already accomplished on standardized files. Electronic transmissions will be an important addition to that process. Test scores from national testing services could be transmitted electronically. Enrollment certifications to lending institutions are already being standardized for electronic transmission and certification of athletes for intercollegiate competition seems possible. The electronic exchange of financial aid transcripts is another likely application. Also, interest in electronic payment systems, often referred to as electronic funds transfer, has been growing (Emmelhainz, 1990).

Other Benefits

It is also likely that a number of secondary benefits will result from SPEEDE implementation. SPEEDE may lead to a national accreditation data base, and potentially, a national course data base, which could be accessed electronically by admissions and registrar offices around the country. Vendors could use the SPEEDE format for integrating their product with an institution's system to simplify the implementation of purchased software. The standardized format for transcripts could lead to the development of a standardized format for admissions applications. If so, students could apply for admission using microcomputers in high school advisement offices, electronically forwarding the application and high school transcript to the universities of their choice. Data entry, probably the most significant investment of support staff resources at present, could be almost totally completed by the students, themselves.

FIGURE 5: ***Integration of SPEEDE With Other Student Service Software***



Integration of SPEEDE With Other Student Service Software

SPEEDE, itself, has many benefits over our current paper transcript environment; however, the greatest benefit of SPEEDE implementation will be realized when it is integrated with other student service software to provide a complete information package. Follow the steps in Figure 5 as you **consider the total service which will be possible: a student electronically submits a request to have his/her transcript forwarded to another institution; the student's record is prepared in the SPEEDE format and sent electronically to the receiving institution; the receiving institution receives the transcript in the SPEEDE format and converts the record for direct entry into its student data base; the record is passed to the institution's transfer evaluation system and course equivalencies are assigned; the record is forwarded to an automated degree progress summary system and a degree progress check is completed, which the student accesses directly through touchtone telephone, student direct access terminals, or automated teller machines which are readily available. This electronic delivery of total service will be the greatest benefit of SPEEDE to institutions and to students.**

User Concerns

In any discussion of benefits and positive effects of SPEEDE implementation, it is essential to point out potential pitfalls or shortcomings that are frequently raised when applications of electronic technology to student support services are proposed. One of the first issues raised with any proposal for increased use of computer technology is the charge that computers dehumanize the delivery of services. That danger is ever present and planners for increased use of technology in service areas must proceed with caution to assure that attention to the humanization of services to students and staff parallels the technical development. While institutions move toward greater application of technology to routine daily procedures, they must remain sensitive to the concepts of "user/student friendly" and "customer satisfaction". Increased use of technology to deliver routine services results in more human resources available to assist and serve students who need attention. Rather than dehumanizing services, appropriate application of electronic tools to routine processes enhances the humanization of services.

A second area of concern focuses on the privacy issue. Electronic data processing provides greater efficiencies in accessing, reformatting, and transmitting data. Increasingly large amounts of data, public and private, are being passed around and being held in more data bases. Privacy issues in relation to electronic data have been a concern for decades and these concerns increase with each new technological development. Those working with electronic data must remain sensitive to this issue with each new application being installed--including SPEEDE.

What Is the Status of SPEEDE?

Mary Neary, Assistant Registrar at Arizona State University and member of AACRAO's SPEEDE Committee, summarized known SPEEDE developments for transmission over the SPEEDE ListServ and distribution at the October 20-22, 1991 SPEEDE workshop in Madison, Wisconsin. The following, supplemented with later updates, was gleaned from that summary and describes the status of SPEEDE nationally.

In alphabetic order by state, the following reports institutional activity in eight states. **Arizona** State University is converting to SPEEDE from a locally designed system with the Maricopa Community College system. The University of Southern **California** and two community colleges are working together on a pilot. The University of California has created a system-wide task force to explore the feasibility of EDI applications, including electronic transcripts. In **Florida**, 13 of the 28 community colleges and five of the nine state universities utilize electronic transcripts. Twelve of 67 high school districts send transcripts electronically and all districts accept electronic requests for transcripts. Eleven campuses in **Maryland** are involved in a local format of electronic transmissions and now have the ability to use SPEEDE. The **Ohio** Association of Collegiate Registrars and Admissions Officers has formally endorsed SPEEDE and a statewide group is being formed to promote SPEEDE development. **Oklahoma** University, Tulsa Junior College, and Oklahoma City Community College have begun a three-way exchange project. Twenty three north **Texas** institutions utilize electronic transcripts.

In **Wisconsin**, an ad hoc committee was formed by the University of Wisconsin System (13 degree campuses, 13 two-year campuses, and an Extension Division) to study the feasibility of SPEEDE as a means of exchanging transcripts electronically. A part of that committee's activities resulted in a prototype SPEEDE system developed at the Stout and Whitewater campuses. In January 1992, the Wisconsin Association of Collegiate Registrars and Admissions Officers (WACRAO) established a WACRAO SPEEDE Committee. The primary charge to this committee is to stimulate SPEEDE development throughout the State of Wisconsin.

In addition, exciting activity is taking place among institutions across state borders. The University of **Texas**-Austin has exchanged sample packets of SPEEDE transcripts with both Miami-Dade and Edison Community Colleges in **Florida**. **Arizona** State University and **Oklahoma** University have joined this pilot project.

Since postsecondary admissions offices stand to realize substantial benefits when high schools begin transmitting transcripts electronically, it is encouraging to note that the National Center for Educational Statistics (NCES) Task Force has successfully completed the first phase of a pilot with school districts in **California, Florida, New York, Texas,** and **Washington**. This pilot will expand to begin transmitting to SPEEDE colleges and universities. This NCES Task Force carries the acronym of ExPRESS (Exchange of Permanent Records Electronically for Students and Schools).

Clearly, SPEEDE is under development on many fronts across the country. How did it arrive at this level of activity in such a short time? The origins of the SPEEDE concept may be traced to the April 1988 AACRAO annual meeting. Under "Milestones in the History of the SPEEDE Project" on page 1.17 of the October 2, 1991 issue of A Guide to the Implementation of the AACRAO Electronic Transcript is the following reference:

> "At the AACRAO annual conference in Nashville, TN, there were several presentations on the use of electronic media to exchange high school and college transcripts. As a result of these program sessions, considerable interest was expressed among some AACRAO members. At that time, it was known of the existence of the projects actually under way in Texas and Florida. It was also understood that other states or groups of institutions were in planning stages for similar projects.
>
> Several AACRAO members approached then Vice-President for Data Management and Research, Gary Smith (University of Missouri at Columbia) about the need for a standard national format for the electronic transcript. It was felt that AACRAO was the appropriate association to create such a standard if it was possible to do so."

In August 1988, the task force (later known as SPEEDE) was appointed to make recommendations to the AACRAO Executive Committee by February 1989 concerning the feasibility of the project. At its meeting in January 1989, the task force unanimously agreed that the project was timely, worthwhile and do-able. It also prepared a very rough draft of the format and agreed to try to establish an ANSI ASC X12 standard for the electronic transcript. In January 1990, Tom Stewart, Registrar at Miami-Dade Community College, represented SPEEDE at a meeting of the Pre-K through 12 NCES task force (ExPRESS).

A pilot project to exchange student transcripts using the AACRAO SPEEDE format was initiated by Miami-Dade Community College and the University of Texas at Austin in February 1990. In April of the same year, the SPEEDE task force formally submitted a project proposal for the student transcript transaction set to ASC X12.

The Pre-K through Grade 12 NCES task force met in July 1990 and agreed to work on the transaction set. Don Spiegel (DISA X12) encouraged that group to modify their proposal so that it would more closely conform to the one proposed by SPEEDE. This was later accomplished.

A proposal was submitted in August 1990 to ASC X12 for a transcript acknowledgement transaction set. In November, the SPEEDE task force held its first workshop with approximately 100 attendees in Scottsdale, AZ., where the first draft of the **Implementation Guide** was distributed. It was later distributed to all member institutions of AACRAO. Tentative approval by the ANSI ASC X12 Committee was received in February 1991 for the transcript transaction set. In June, approval was received to send the student transcript transaction set out for a formal ballot for approval of the X12 membership. The ballots were received in September with 53 approvals and 3 disapprovals. Responses were presented as the next step at the October 1991 X12 meeting. The second SPEEDE workshop was conducted in Madison, WI on October 20-22, 1991 with 151 in attendance.

In summary, a great deal of activity is occurring nationally with SPEEDE. Since its inception in August 1988, the AACRAO SPEEDE committee has made phenomenal progress in a very short time. This progress reflects at least two obvious facts--(1) the time for this idea has come, and (2) the SPEEDE task force has been very effective, not only in developing SPEEDE, but in promoting the SPEEDE concept nationally.

SPEEDE in Wisconsin

Upon return from the 1990 Arizona SPEEDE workshop, the University of Wisconsin created a multidisciplinary and multi-campus ad hoc committee to study the feasibility of SPEEDE in Wisconsin. The committee was comprised of admissions, registrar, data processing, networking, and system project management staff. The committee formed two sub-committees--a user group and a technical group. One of the major activities of the technical group was to develop a prototype/pilot project between two of the University's campuses; namely, Stout and Whitewater. The report of this prototype project follows.

Technical Issues and Assumptions

The detail technical assessment of SPEEDE began in March 1991. The technical group identified five issues/assumptions to guide the evaluation effort. It then divided into smaller groups for analysis purposes. These five issues/assumptions are described below along with a brief report of the analysis results.

1. *SPEEDE must use the Internet, CICNet and especially WiscNet.*

   The use of the WiscNet network for the sending and receiving transcript information was considered mandatory. Any SPEEDE implementation that dealt only with proprietary networks was inappropriate given the investment in WiscNet and the concentration of inter-institutional communication activity expected of WiscNet. In addition, because all system institutions are part of WiscNet, they have simultaneous access to CICNet (the Big-10 plus the University of Chicago), and the Internet, which when combined represent more than 600,000 connected host machines.

   Analysis: The WiscNet network assumption was an early casualty. Virtually no one involved in the definition of SPEEDE or in early pilot efforts had considered using the internet as the network component. Therefore, there was no body of knowledge for interfacing the SPEEDE process into the default academic network standards. Others who were interested in using the internet were identified and the sub-group decided to retain those contacts (notably Virginia Tech, and two Canadian institutions; Carleton University in Ottawa and the University of Waterloo) for future contact.

2. *SPEEDE is perceived as too complex and hence too expensive.*

   SPEEDE appears to be an enormously complex application; the guidelines for implementation are replete with seemingly endless tables of codes and alternatives. Because of this apparent complexity, the task of understanding the standard sufficiently to implement it reliably is seen as very time consuming and, therefore, too costly.

   Analysis: The apparent complexity problem was a central issue. It was known that development staffs system-wide were, in general, scheduled with high priority projects months and years into the future. Having to deal with a difficult and complex project in addition to existing work loads would probably lead to SPEEDE being relegated to a lower priority than its complexity really deserved. To counter the complexity issue would require good solid analysis and data from institutions that had actually done development work on the standard. Unfortunately, those institutions which were contacted felt development costs and timetables they might share were far too preliminary to be of value.

3. *There are few current SPEEDE users.*

   The true value of SPEEDE is in its universal (or nearly so) implementation. The lack of a large number of SPEEDE institutions reduced the number of sites that UW System was able to work with in testing and debugging the programs written for the prototype.

   Analysis: Not being able to acquire data relating to the development costs from other institutions introduced a corollary problem of having no one to work with should a pilot system actually be developed. This was judged to be a significant issue for future consideration but not sufficient to derail present efforts.

4. *The UW system has some unique data requirements.*
   The UW System Board of Regents has mandated that every UW System institution list all courses that were transferred from other System institutions on its transcripts regardless of how the receiving institution accepts the courses. There is also a system-wide agreement that each UW System institution list matriculation date as part of the transcript data.

   Analysis: The analysis concerning the uniquely Wisconsin elements indicated SPEEDE could handle them with relative ease. While these "local" elements are outside the standard, it is assumed when an institution outside the UW System receives a Wisconsin transcript, that institution will simply ignore the special fields which UW System institutions append to the SPEEDE file.

5. *Development of SPEEDE must be sharable.*
   For SPEEDE to be quickly and successfully implemented throughout the UW System, a significant amount of development sharing must occur. Wisconsin, like other states, is searching for mechanisms to share expertise, program design, and even program code wherever feasible to reduce the development costs.

   Analysis: The development sharing issue was addressed directly in the prototype activity. The two UW System institutions involved in the prototype shared analysis, and to the extent possible, program code. It is assumed that significant savings in analysis can be captured based on sharing the prototype activities knowledge base. Actual sharing of code will be more difficult. Each UW System institution has developed student record systems in direct response to their local faculty and administration's policy and procedures. Therefore, one institution's program code does not transfer to another institution. However, the fundamental logical and process elements of the SPEEDE implementation are transferable and savings will be realized as the prototype knowledge is extended into the system.

Prototype Activity

The technical sub-committee was initially concerned about SPEEDE's complexity and questioned the probability of its implementation. But, upon close inspection, **the SPEEDE standard was found to be sufficiently mature and adequately defined for implementation.** Because adequate data from other sources was not obtainable, a UW System prototype effort was the best approach to simultaneously obtain implementation cost data and to test the standard. Such a prototype was intended to generate cost and design details that would be useful to other system institutions as they considered SPEEDE.

The sub-committee proposed the development of a SPEEDE prototype system between two UW System institutions because of its confidence that it could produce a SPEEDE send function at one institution and a receive function at another institution. Implementation of a prototype within Wisconsin offered an opportunity to test several factors, including key issues in the assumption set.

The Technical Sub-committee viewed the SPEEDE implementation as a function stack comprised of the following elements:

✓ Request

✓ **[Format Outbound SPEEDE File]**

✓ TCP/IP Network
Addressing/Encrypting/Acknowledgment

✓ **[Decode inbound SPEEDE file to local format]**

✓ Pending Admissions
Course Equivalency
Degree Audit
etc.

The plan was to design and program the events dealing with the actual encode/decode process, i. e. the items "between the brackets"--(format outbound SPEEDE file) and (decode inbound SPEEDE file to local format). The balance of the identified events were considered to be very locally dependent or not yet nationally defined. For example, the events associated with a SPEEDE transcript request will vary with each institution. Some institutions may wish to offer a walk-in personal request process while others may implement a telephone based touchtone request system. Likewise, the post-receipt processing options of course equivalency or degree audit will vary depending on local policy and the availability of automated tools to perform those functions. The network issues, including use of the internet (TCP/IP), acknowledgement, and security continue to evolve.

A limited scope project definition and a funding request was submitted to UW System administration in May of 1991. The funding request was approved in late June. UW-Whitewater began design and development of the SEND portion of the transaction, while UW-Stout began the RECEIVE portion. The pilot campuses would use WiscNet's file transfer capability (TCP/IP - FTP) to move SPEEDE files between the institutions.

The goal of the sending institution was to extract transcript data from the student record system data base and format it into a SPEEDE file for transmission to the receiving institution. Following a complete review of the SPEEDE Guidelines, one programmer was assigned to work with both the Registrar's Office and the Admissions Office. These offices assisted in the interpretation of the data elements in the SPEEDE guide.

The goal at the receiving institution was to generate a locally defined transcript from a SPEEDE transmission. Two programmers were assigned to review the SPEEDE implementation. In addition, the Director of Student Records was recruited to help define, clarify, and localize the SPEEDE documentation.

The approximate investment in staff hours to implement the basic UW-Whitewater 'send' and the UW-Stout 'receive' functions are:

	HOURS	
Staff Type	Whitewater (Send)	Stout (Receive)
Programmer/Analyst		
• Original send or receive function	173	120
• Upgrade to 10/2/91 SPEEDE release	50	30
• Develop full send and receive	66	70
** P/A sub-total	289	220
Admin/Meetings, etc.	68	40
Registrar's Office	12	16
Admissions Office	10	8
Project Total	379	284

Both the send and receive functions were operational by late September 1991. UW-Whitewater and UW-Stout exchanged code and system analysis experience and developed complete send/receive systems at each campus. These complete send/receive systems were implemented in test mode by mid-January. The report of this prototype activity at the October 1991 SPEEDE Workshop and at the 1991 Annual WACRAO Meeting has stimulated a great deal of interest in all sectors of education in Wisconsin--public/private and K-12/postsecondary--as evidenced in the establishment of a WACRAO SPEEDE Committee and many campus SPEEDE committees.

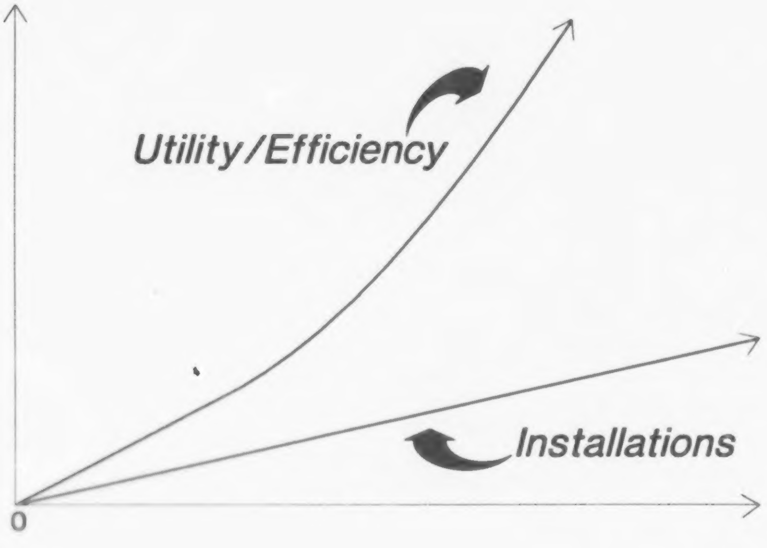
Conclusion: Where Is SPEEDE Headed?

This paper identified the need for higher education to catch up to, or at least keep pace with, the electronic technology field by applying available electronic tools to student academic support services. It then described one such application, i. e. using the EDI technology to send and receive transcripts--SPEEDE. The paper described SPEEDE and listed several benefits as well as some concerns. It summarized the present status of SPEEDE applications nationally and reported on the progress of the AACRAO SPEEDE committee. It also described the Wisconsin prototype project.

At this point, the question of where SPEEDE is headed naturally emerges. SPEEDE, of course, will continue to move forward. This is the direction that exchange of information is moving, and moving rapidly, both in business and in education. However, one potential roadblock that may impede SPEEDE's progress is the need for a **critical mass** of participants to realize a return on the investment in developing SPEEDE. SPEEDE is a type of development that is different from campus independent developments such as registration and automated degree summaries. For SPEEDE to be successful and cost effective at a specific campus, SPEEDE must be in place at other locations with which some volume of transcript exchange occurs.

SPEEDE requires only three things to work--an on-line transcript system, a sender, and a receiver. However, the level of benefits to be realized from SPEEDE development parallels in a very important way the level of benefits realized from telephone or FAX installations--"if you have the only one, with whom will you be communicating?" Like telephones and FAX, the more SPEEDE installations in existence, the greater its utility and the more efficient transcript exchanges become. As illustrated in Figure 6, a linear increase in SPEEDE installations results in exponential increases in utility and efficiency in transcript exchanges.

FIGURE 6: Linear *Increase in Installations; Exponential Increase in Utility/Efficiency--SPEEDE, FAX, Telephone*

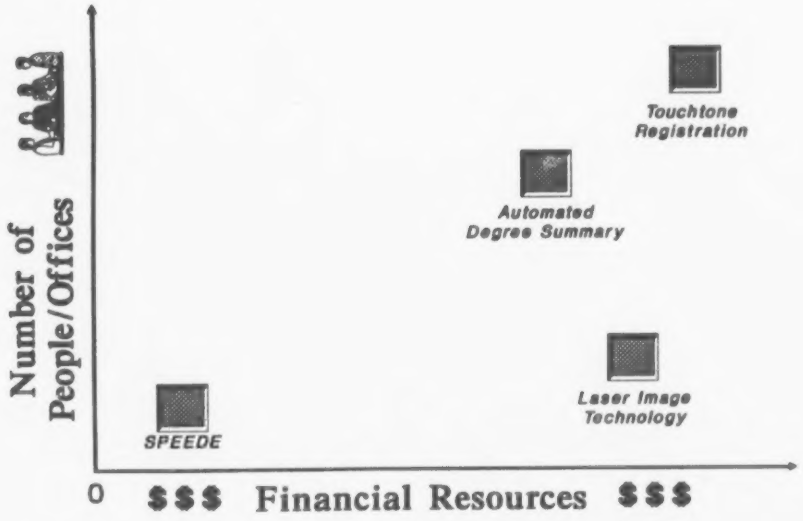


For example, two University of Wisconsin campuses can exchange transcripts at present. The resulting efficiencies are restricted only to transcripts for students transferring from one to the other of these two campuses. When all 26 University campuses have SPEEDE capability, the efficiencies increase exponentially to the 26 campuses. The addition of the technical and private institutions in Wisconsin would result in similar increases in utility. When Wisconsin school districts install SPEEDE capability, the utility/efficiency curve will turn upward sharply. Implementation of SPEEDE at professional school admissions services, teacher certification agencies and institutions in neighboring states will continue the exponential upward trend of this curve. Thus, the ultimate value of SPEEDE is dependent on its development on all fronts.

It is essential for supporters of this concept to successfully move SPEEDE from the idea stage to implementation on their own campuses. Figure 7 illustrates a concept that may be helpful to those reviewing SPEEDE development possibilities. Inherent with each proposal for a new development is a degree of difficulty in selling and installing the concept. Two major factors contributing to that degree of difficulty are (1) the number of people/offices involved in (or impacted by) the development and (2) the financial resources required. As increases occur in one or both of these factors, the level of difficulty in implementing a new project increases. Figure 7 shows that the development and installation of a touchtone registration system ranks high in difficulty on both of these factors, as does automated degree summaries. Installation of a laser image system in a registrar's office would rank high on financial resources required, but low on people/office involvement since it is a project internal to one office.

Fortunately, SPEEDE ranks low on both factors. First, its development involves primarily the sending office (registrar), the receiving offices (admissions offices), and the student data processing office; and, second, information from pilot developments suggests developmental costs are very modest.

Figure 7: ***Level of Difficulty in Selling and Installing SPEEDE***



However, the installation of SPEEDE on one's campus is only the beginning. To achieve the **critical mass** of institutions participating in SPEEDE, it is not enough to focus only on installing it on one's own campus. It is essential to market this concept among all potential users--other campuses in the system; colleagues in state and in national professional associations; high school districts; state teacher certification departments; professional school admission services, etc.

There is no single right answer, formula, or approach which will ensure that any given good idea will be accepted in any office, on any campus, on any institution, or in any state. Even though each entity is unique and no one right approach exists, most of these organizational units possess certain similarities among their environments within which a number of specific common or similar elements can be incorporated into the process to move SPEEDE successfully from the idea stage to implementation (Gawkoski et. al., 1990). Good salesmen, missionaries, those effective in marketing--all are able to find those elements within their working environments and capitalize on them.

In conclusion, it must be emphasized that each successful SPEEDE development will contribute (1) to the development of that **critical mass** of SPEEDE users and (2) the narrowing of the technology/utilization gap in higher education.

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37th Annual College and University
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"Discover New Worlds With Technology"

T2-4

From Need to Implementation Development of a Microcomputer Application

Fred Holtzman
University of Tennessee

From Need to Implementation
Development of a
Micro Computer Application

Presented by:
Dr. Fred Holtzman

CUMREC 92 - Miami

Tuesday, May 5, 1992

Abstract of Presentation:

The development of a micro computer application that really meets user needs is often an elusive objective. This presentation will walk through the process of developing such an application. A departmental bookkeeping system, the Budget and Expenditure Application (BEA), will be used as a real world example in a setting of higher education. BEA is currently in use by 32 departments at The University of Tennessee - Knoxville and is under evaluation for use by other departments at UTK and throughout Tennessee.

Overview of Steps:

- **General Background**
  - Micro Application Development and Support

- **Orientation**
  - Environment

- **Requirements**
  - Analysis and Brainstorming - Extraction of expert knowledge
  - Identifying output requirements and input formats
  - Design flow - pseudo coding logic

- **Methodology**
  - Prototyping - Clarion
  - Phase I Implementation - making the original idea work

- **Finishing Touches and Maintenance**

  - Documentation development and help screens
  - DOS functions - backup, download, upload, file transfer
  - Bullet proofing

- **Growth and Support**
  - Steering Committee and Version Control Policy
  - Self installing disks and copyright protection.

- **Summary - A Formula for Success**

Environment

Micro computer application development, as stipulated here, begins with ideas generated to address a specific need. These ideas will naturally come from the individuals or "experts" currently involved in the day-to-day activity of addressing the problem. This expert is typically a member of the academic or administrative staff of an institution of higher education. In a grass roots approach, front line people become the best resource. Analytical interview techniques are used to extract expert knowledge. In our environment, this is the responsibility of a systems or programmer analyst.

At The University of Tennessee, most departments are connected via ethernet (thin wire cabling) within buildings and fiber optics cabling between buildings. This backbone links over 4000 PCs, 23 Novell File Servers, IBM and DEC Mainframes and a number of Unix Workstations.

Finally, a programming language capable of handling the task must be chosen. Any of the traditional languages from BASIC to C could be used. We prefer to use a 4GL which is designed to handle relational databases. At UTK, we have selected Clarion as our language of choice for application development. It is fast, easy to use (once you master the fundamentals) and greatly expedites development and maintenance efforts. The end product is a self-contained, standalone, executable file which provides a quick and elegant solution.

The Players

The Problem/Need: Departments at UTK have a need to maintain accurate and up to the moment knowledge of their budgets and expenditures. The Treasurer's Department maintains accurate records for all departments, paying invoices and providing ledger sheets of paid transactions. The paperwork associated with these operations placed severe limitations on the timeliness of centrally available data.

A mainframe solution was available. It, however, did not provide the kind of fingertip control, proximity and immediacy that was desired. Also, if the mainframe or its peripherals went down, so did access to the desired budgetary information. Could this data be captured and maintained locally on a microcomputer and provide more timely reporting methods?

The Expert: Joyce Varnum, Senior Accountant, College of Veterinary Medicine, Department of Urban Practice.

The Analyst: Dr. Fred Holtzman, Senior Programmer Analyst, Department of Administrative Computing.

The Programming Language: Clarion

Analysis and Brainstorming - Extraction of Expert Knowledge

It all began with a series of informal meetings between Joyce and myself to identify the problem to be solved and consider various alternatives. Lotus was considered, but it tends to be unforgiving and managing of large quantities of relational data is certainly not its specialty. We sketched, in somewhat broad strokes, our ideas and the structure of required functions.

Determining Output Needs, Input Formats

Input and output requirements were then considered. This was accomplished through informal ART interviews. ART is an interviewing method developed by the Department of Technological and Adult Education of The University of Tennessee. It facilitates the identification and extraction of expert knowledge for program development. The initial file requirements and their structures were determined, including the number and size of their fields. The basic system would consist of the following files: Invoices, Accounts, Object Codes (sub accounts), and Purchase Orders. Invoice information would be entered into the invoice file. As this was done, the system would transparently update the three secondary files.

Current treasurer's reports, along with reports which Joyce assembled by hand to present the budgetary information to her department head, were used to guide the application development. A report showing year-to-date budgetary figures would be of primary concern. Reports showing expenditures by account number and by account number and object code would also be created.

A method to initialize and maintain yearly budgeted amounts for accounts, object codes and purchase orders number was also necessary.

Design Flow - Pseudo Coding the Logic

Furnished with the above information, initial logic flow and pseudo codes were sketched out. With Clarion that is all that is needed to get started. It maintains file structures and hierarchial charts internally.

Proposal for Work

A proposal for work was then officially submitted to the departmental head of Urban Practice for approval. This document contained a high level functional description of the work to be done with an estimate of the time and cost involved. The document served as a definition of project scope. When the project was approved, work began.

Prototyping - Clarion

Using the advanced screen and report formatting capabilities provided by Clarion, the initial prototype was put together in a matter of days. When creating an application of this type, it is necessary to have standards for screen and report layout. At UTK we have adopted guidelines for departmental applications. These standards are based on the use of IBM equipment, preferably PS/2s with color monitors. The results are pleasing to the eye, easy to read and readily highlight pertinent material.

Phase I Implementation

With a working prototype, I returned to the College of Veterinary Medicine and introduced Joyce to our project. She was very pleased and immediately, using her expertise, began to spot weaknesses and areas for improvement.

It is so important to allow the user to frequently view and test drive applications under development. It can prevent the programmer/s from writing a program to suit their idiosyncracies rather than to actually meet the user's needs. The programmer should have the attitude of meeting the unique needs and desires of the user wherever it is practical within the limits of the language employed.

Debugging and Initial Mods - Making the Original Idea Work

Thanks to Joyce's initial critiques, I was able to immediately improve the system. My own programming experience began to interplay with her expert knowledge base to enhance it further. We were able to develop an excellent working relationship, which only made the results better. I want to maintain the attitude that I can learn and improve from my users. Sometimes it is necessary to tell the user what limitations exist and when their wants cannot be reasonably achieved.

We exercised **scope control** and limited our objective to making the original idea work. An easy pitfall is beginning to make enhancements, supplying bells and whistles before the basic application is completed. When something goes wrong, it is even harder to find because the initial code was not thoroughly tested. We tested the code and Joyce used it for a month. During this period many iterations of this modify and test cycle were made. Multiple corrections were made and incorporated within a very short period of time. All seemed well.

Documentation Development and Help Screens

The next phase was to develop user documentation, a step frequently overlooked. I use WordPerfect to write our documentation. To capture images, I use Side Kick to "take pictures" of all screens. To capture reports, I use public domain software called prn2file. This sends my print output to a file I designate. I then merge both of the images in these ASCII files into the appropriate places in my documentation, and massage them to fit.

To create help screens for the program and to check on the usefulness of my user documentation, I returned to my expert. Joyce reviewed my work, making her usual corrections. We approached the help screens from the standpoint of what would an individual need to know to operate the system if the normal user was not available. Clarion readily facilitates the development of context sensitive help screens. Multiple levels of help can also be developed.

DOS Functions - Backup, Download, Upload

One of the major needs of all micro applications is the creation of regular backups. To facilitate this, a DOS interface section was built into the program. When backup is selected, the user is guided through the process of entering a disk and backing up. We make the process more efficient by zipping the files with Pkzip. This will work until the files grow so large that one 1.4 meg floppy will not accommodate them. However, for this application, it is estimated that will take several years.

In addition, the DOS interface allows the user to set date, time and perform data downloads and data uploads. In some installations, a sneaker net is used to transport data between computers. The required data can be readily ported from one computer to another by downloading and uploading. The system can readily be converted to a Network version.

Bullet Proofing

Within a short period of time, several new departments purchased BEA and began using it. This really became the acid test of its reliability. It is one thing for the programmer or original user to run through a program, figuring out the right thing to do next as they go. But a user more removed, although equally skilled in accounting tasks, is somehow capable of finding loopholes in the logic and bringing the system down to its knees. And, so it was with BEA.

No provision had been built in to prevent a user from creating orphans. Components of existing invoices could be deleted without considering the invoices. For example, an active purchase order number which was assigned to an invoice might be deleted. The invoice would then be orphaned and complications would arise for making further changes.

Provision was made to prevent the creation of orphans. Password protection, with set access levels, was built in to limit deletion capabilities. When users tried to do something they should not but did not know they should not, they were gently told no.

Multiple Users and Version Control Policy

The BEA program was originally designed to be used in one office. It soon was installed in various other departments. Not only did it provide locally controlled and timely information, it also provided a simple and elegant solution to a tedious, time consuming and error prone task. By word of mouth and articles in various newsletters, the word spread. Within one year, it was in use by 11 departments. By the end of two years, BEA was installed at 32 locations.

It was determined up front that only one version of this software would exist at one time on campus. Whenever changes, corrections or enhancements were made, all users would be updated. This made our support activities easier. Each new version has a new number assigned which appears on the initial screen.

Steering Committee

New users meant requests for modifications and additional reports. Not all requests are implemented. We continue to limit the scope of this application, keeping in mind its reason for existence. A Steering Committee was established to determine the validity and usefulness of these requests and to arbitrate the equitable distribution of the cost.

Any and all changes, except for bugs, must be paid for by the users. Sometimes a report or enhancement will only benefit one or two departments. In that case, they share the entire cost. In other cases, costs are equally distributed among all users for general enhancements.

Self Installing Disks and Copyright Protection.

We have now begun to get requests for BEA from institutions outside the immediate University of Tennessee campus. As a result, it was necessary to develop self installing disks and copyright protection. This has been done. Each application disk is pre-configured with the name of the institution that is previewing or purchasing it.

Summary - A Formula for Success

In reviewing the development of BEA, several general principles or guidelines were gleaned which contributed to its success.

- The project was truly grass roots. It was initiated and designed around the needs, vision, energy and active participation of the primary user.
- Prototyping was used with multiple iterations of user review and evaluation.
- Control of application scope.
- The product is intuitive and visually appealing.
- It was easy to learn and work with, even enjoyable.
- Tasks characterized by tedium and with a potential for error were expedited.
- Changes, made to order, were conveniently available and timely.
- The evolution of the product was managed and coordinated by a committee made up of the users and the analyst.
- It met the need it was designed to meet simply, concisely, attractively and securely.

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T2-5
Information Systems are Strategic

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Information Systems are Strategic

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Introduction

Initially employed in business to improve the efficiency of handling high volume, daily business transactions, information systems (IS) have evolved over the last three decades to a position of strategic importance in many corporations and, more recently, universities. Based on some well-published successes, a consensus is emerging that institutions must look to information technology to provide a competitive advantage in order to assure future profitability and growth. How information systems are managed and organized within any organization are clearly important in exploiting this potential, but choosing an organizational structure and management style is complicated by both the historical development of information technology and current divergent forces concurrently favoring and opposing centralization of computing within the organization. This conflict has hampered the institutionalizing of strategic information systems.

Information systems have been looked upon as having little or no effect upon the decisions of higher management other than cost. Few considered the added tangible or intangible value possible from strategic computing. As such, Information Technology (IT) functioned as a support or service activity, and only its lack of smooth operation was of concern. Information Technologies were thereby subordinated to management's main areas of interest. Increasing competition in the marketplace, however, has caused many organizations to realize the new strategic role of information systems. Consequently, strategic information systems, computer systems which significantly change the organization's external competitive position and internal productivity, have gained prominence in industry.

Applying these principles to the university environment is rarely discussed and, even more rarely, instituted. The purpose of this paper is to show the major error of this omission and how thinking of computer application systems as strategic, and managing accordingly, can have a major effect on the culture of your university and the way it does business.

External Effects From Strategic Information Systems

From an external viewpoint, strategic systems influence some or all of the following areas:

Image: Systems visible to the community of recruiters, donors, alumni, prospective students, faculty and staff can be strategic. Voice response units, sophisticated development systems, access to high school recruiters by modem and prompt payments to vendors all have a bearing on "image".

Revenues: Raising money and increasing the number of students are not the only revenue sources for strategic system implementation. An accounts receivable system reducing the outstanding debts and their longevity is strategic. Purchasing and accounts payable systems integrated with financial reporting allows discounts from vendors to be taken.

Market Share: For universities, there is a reduction of quality and quantity in the supply of customers, the students. Buying the best with scholarships and financial aid packages, which can be modelled by computer systems, provide competitive systems gaining market share.

Internal Environment Analysis

The university environment is even more interesting than corporate America. The university is not merely an educational institution. It is a business and political institution whose purpose is to educate and conduct research in order to advance the knowledge base of the universe. Since this is basically the same mission producing a similar product among 3500 institutions of postsecondary education, there is a strong need to achieve competitive advantage. In the education industry as well as other more publicized industries, such an advantage can be gained by product differentiation, cost leadership, or by providing "better" services.

Often universities are not viewed as operating in a highly competitive environment by the unknowing outsider to the industry. In the areas of recruitment/admissions, development/university relations and financial aid awards the external environment can be supercharged competitively. Road shows throughout the country are designed by recruitment specialists in order to recruit the best and the brightest from a dwindling pool of qualified high school graduates. Scholarships, grants and loans for students either need-based or scholarship driven are incorporated into a "compensation" package for highly desired recruits. Following the models designed by the leading athletic directors, the recruitment of academic All-Americans is as intense as Football recruiting and less controlled by any outside agencies. There are no NCAA reviews of recruiting academic stars. In addition, major development campaigns of $400 million and up are becoming common place among private research institutions. These fund raising efforts have become even more competitive because of the decline of federal funding for research and the decreasing student pool.

The recruitment of researchers, faculty and competent administrative personnel has also become highly competitive. The compensation packages include graduate assistants, computing facilities, research laboratories, home financing at below market rates, employment for spouses and country club memberships. These perks are in addition to salaries of at least 25% above their current level. There are over 50 vacancies for Deans of Business Schools. The deals being negotiated, while not quite at the Wayne Gretzky or Dan Marino level, contain long term commitments for salary, benefits, tenure, resource and budget support, directorships on local corporate Boards and a "no-cut" contract. The necessity of creating and utilizing strategic systems in support of these realities has become a prime focus of leading institutions.

Competitive Advantage From Information Systems

The concept of using information systems to obtain a competitive advantage dates back as far as the 1960's. However, "only since 1982 has there been a systematic pattern of structural changes and market-share changes achieved by information technology" (McFarlan,quoted in Rosenberg,1988,p.60).

One example is the domination of the Apollo and Sabre airline reservation systems owned by United and American Airlines respectively. Together these systems command 80% of the market and have left competitors scrambling for the remaining market share. So significant is this domination and barrier to entry, most other air carriers have brought suit on antitrust grounds. Another example is the development and domination of interest bearing money market accounts by Merrill Lynch, working in conjunction with Banc One. Current interest in obtaining competitive advantages is spurred by these and other similar successes.

Computer systems are strategic systems only if they change business performance in a positive manner. Competitive advantage primarily derives from either a lower cost structure or product differentiation. A useful concept for examining competitive advantage is the value chain which views a university's activities from a systems perspective beginning with recruits and ending with alumni. An understanding of this concept should cause leaders to look beyond their internal operations for opportunities to strengthen ties and obtain efficiencies. High School counselors, donors, government agencies and suppliers are all affected by strategic systems. The ultimate market value of the university's product is the amount consumers are willing to pay for it. A company is profitable only if the value it adds to the product exceeds its cost. Information systems can increase profitability by lowering costs, increasing value or both (Porter and Millar,1985,pp.149-160).

The added value gained by the higher education student is difficult to measure. In fact, the measurement has probably been ignored for fear the truth will hurt. After all, if a student enters college with a 1450 SAT, subsequently graduates, and then gets into a distinguished graduate school, can we definitely attribute that "success" to the institution? Would not a 1450 SAT student have succeeded had he or she attended any institution? No one retests the graduating student to view his or her SAT at graduation. A college that admits a student with a 1000 SAT who tests at 1450 at graduation has truly received added value. Would this not be a marvelous recruitment advertisement, resulting in competitive advantage?

Product Differentiation

Computer aided design allows manufacturers to lower costs by speeding design time and reducing engineering input. Some drug store chains have successfully differentiated their product by providing customers with an on-line prescription history at all their pharmacy locations through a computer network. Digital Equipment Corporation has been successful in both lowering costs and differentiating their computer products with the use of their expert system, XCON, which allows computers to be custom designed to individual customer requirements (Boon,1988,pp.191-201).

Higher education institutions can and do differentiate their product. They just do not realize it. We assume this is not intentional on their part, since obviously, institutes of higher education expend enormous amounts of energy and resources in attracting their best students. The characteristics of institutions are publicized in their brochures. The climate, locale and kind of physical facilities; the faculty-student teaching ratio; the size of the institution; its diversity of offerings and research faculty; the quality of their support systems; the jobs received by their graduates, along with the graduate schools they attend are a few of the differentiations noted.

Internal Effects From Strategic Information Systems

Information systems can also impact the internal operations of a University. Systems can significantly change its operations, adding quality to the output of the university, and increasing productivity and effectiveness in all areas involved as measured by agreed upon service cycles. Systems which enable these types of changes are strategic necessities.

For example, a Campus Directory is a foundation system and a strategic necessity. It consists of consolidated biographical data on all persons and/or companies of interest to the university (such as employees, students, alumni, vendors, etc.), and a centralized repository for the addresses of all entities. It is a more efficient structuring of data and avoids the problems associated with redundant data collections. Likewise, Facilities Directory, Student Records, Registration and Human Resources systems are strategic necessities, and required in order for the university to function. These systems will be discussed in the later sections of this paper.

Typically, strategic systems impact both the external and internal environments of an organization. For example, an information system which improves the University's management of cash flows and accountability could lead to significant increases in net revenue and market share due to the University's enabled ability to compete on tuition. In effect, any information system which enhances the competitive position or fulfills a strategic necessity for the University is a strategic system.

Compared to older types of information systems, the magnitude of change or impact of strategic systems upon the University is substantially higher. They add revenue and improve the University's cash flow position by fundamentally changing the way it does business. Strategic information systems must be critically linked to the goals of the University. Their performance often determines the attainment of strategic business goals -such as increasing net revenue and/or enrollment by specified percentages. A strategic system can fundamentally change the way a University conducts business, competes for students, and relates to their customers and suppliers. Summarizing the above, strategic information systems have the following three prominent characteristics: magnitude of impact, linkage to strategic educational and business goals, and the restructuring of operations and relationships with faculty, students, staff and suppliers.

As we explore strategic systems our focus will be on leveraging the University's business performance through the use of strategic information systems. But first, a brief inquiry into the nature of strategy and its management.

Strategy and Strategic Management

Strategies are courses of action a University can pursue in its attempt to achieve established goals and objectives. A strategy is also a plan which integrates the major goals, policies and actions of the University into a unified, cohesive whole. For example, well-formulated strategies can enable a University to effectively focus and allocate its resources into a viable and competitive strategic posture based upon relative internal strengths and weaknesses, anticipated changes in the external environment, and contingent actions of other competitors. It is interesting to note these competitors are not necessarily limited to other colleges and universities, as we show in the following analysis.

A major concern of strategic management is the identification of opportunities and threats present to the University. In the dynamic sense, it tries not only to identify opportunities for adapting to changing market pressures, but also possibilities for changing those competitive forces. We, therefore, expect strategic systems to be opportunistic in nature, exploiting weakness in the competition and, taking advantage of internal organizational strengths and advantageous market conditions.

We have just described the typical Western definition and understanding of the term strategy. Consider the following perspective: "The Japanese don't use the term strategy to describe a crisp business definition or competitive plan. They think more in terms of strategic accommodation or adaptive persistence, underscoring their belief that corporate direction evolves from an incremental adjustment to unfolding events" (Pascale, quoted in Turpin,1992,p.51). Perhaps this alternative definition suggests that the University can benefit from a more flexible and variable approach during its process of strategic formulation. Of course the political dynamics, culture and resources involved will determine the viability of this type of strategic orientation.

We conclude, therefore, that a successful strategy for a University enables a complementary set of services and organizational structures which meet the needs of its customers, and the competitive forces unique to the business of higher education.

The Competitive Forces on Universities

Michael Porter's Competitive Analysis Model (Porter,1980,p.4) provides a framework for studying the nature and level of competitive processes. In his model we are concerned with the relative strengths and weaknesses of the forces which determine the level of competition within an industry. Porter's model has proved useful in facilitating strategic thinking and also in analyzing the competitive context in which Information Technology can be successfully exploited. Porter identifies five forces as determining the dynamics of industry competition:

(1) the threat of new and potential entrants,
(2) the threat of substitute products and services,
(3) the bargaining power of suppliers,
(4) the bargaining power of customers and buyers, and
(5) the intensity of rivalry among competitors.

The motivation behind applying this type of analysis is to identify those forces which can be potentially leveraged by strategic information systems to gain a competitive and sustainable advantage in the higher education marketplace. The goal is to create a favorable competitive environment by shifting the balance of threatening and negative forces to the University's advantage. The following is a brief example of Porter's model to illustrate the potential impact of strategic information systems on the competitive position of Universities.

Potential Entrants

Who are the potential entrants in the higher education business? They are new state schools, private colleges and universities, and other specialized (technical) colleges. As an alternative to traditional academic institutions, the technical colleges offer relatively quick and inexpensive certificate and degree programs for most vocational and paraprofessional careers. Those schools have the ability to compete favorably on price and convenience making them a significant threat to the economically burdened state and private colleges, and universities.

Substitute Products and Services

Possible substitute products and services are quite varied and numerous. Examples include the military, correspondence and TV/video courses, home education, and alternative approaches to higher education such as a "College Without Walls". Here again the success and proliferation of the above substitute products and services in the marketplace are based upon their ability to compete favorably on price, convenience and quality.

Suppliers, Customers and Buyers

In the higher education industry we can group the academic suppliers, customers and buyers because they are effectively the same entity. Suppliers of colleges and universities can be thought of as their source of students, such as high-schools, businesses and the adult, and college age populations. In terms of bargaining position the latter groups are in relatively strong positions because the traditional college age population is shrinking, there are numerous colleges and universities to choose from, and the rising costs of higher education, which has made it one of the most significant purchases of families today.

Rivalry Among Competitors

The threats posed by potential entrants, the increasing number of substitute products and services, the shrinking college age population, and rising costs of providing higher education are all negative factors in terms of the University's position in the marketplace. We thereby expect the industry to be intensely competitive with colleges and universities jockeying for advantageous market position. Rivalry includes recruiting in all areas of the national and international marketplaces by public and private institutions. More than ever, differentiation to sell a particular institution will become paramount.

Improving the "Product" from Universities

In its competition with Japan, American industry, particularly manufacturing, has learned the hard way that "to improve the product you've got to improve the process" (Runkle,1991,pp.67-72). Consider the concerns of the major customer of higher education, U.S. businesses. Their major message to the University is quite simple: improve your core capabilities which are curriculum development and teaching, in other words: get relevant to changing business dynamics; produce graduates who know and can make business processes work, and more importantly have contemporary knowledge as to methods to make them work better. Perhaps this is the central issue to address in answering the question of why America has lost its competitive manufacturing and product development dominance to the Japanese over the past twenty years.

Strategic Systems Implementation: First Steps

Deciding the service order of new systems, or systems to be replaced or maintained will determine resource allocations. Since strategic planning is primarily a resource allocation model, a plan with organizational involvement must be created. Within the plan, a priority setting mechanism for strategic information systems implementation and scheduling is necessary so the journey to a better university can begin. There are also economic, political, social and logical forces to be considered:

Economic: For universities seeking quick gains, the expected net revenue and longevity of funding necessary to complete the project become determinants.

Political: The perceived image of the project within the university and how high in the organization is the sponsor of the system.

Social: The strategic system could be used to "score points" with a particular manager or area of the organization. A favorable probability of success is a necessary consideration because you must build upon success in order to continue with additional systems.

Logical: Is the database design optimal? Are the data structures sufficiently flexible to permit access by other systems? The choice by information system professionals would be to begin with foundation systems and expand from there. From directories, you build to an enrollment management or human resource system.

The resulting priority schedule will certainly reflect the dynamics of the above forces. It is best to start with foundation systems, and build upon their success. A proven track record of successful strategic implementations makes it easier to request continued funding for future systems.

Strategic Systems at the University of Miami

In 1984, the University of Miami began a $15.2 million, seven year Long Range Information Systems Plan implementation. It was completed in six years and seven months and for $14.7 million. Below are descriptions of the major systems and their strategic significance.

Campus Directory: As previously mentioned, a Campus Directory is a foundation system and a strategic necessity. It consists of consolidated biographical data on all persons and/or companies of interest to the university (such as employees, students, alumni, vendors, etc.), and a centralized repository for the addresses of all systems. It is a more efficient structuring of data and avoids the problems associated with redundant data collections.

General Ledger: Provides on-line query and data entry capabilities. Provides all users with up to date account balances, detail transactions, and open commitments. The General Ledger is integrated with the Accounts Payable, and Purchasing systems and provides a full accounting audit trail. This system allows a better use of allocated funds and is a strategic necessity.

Facilities Directory: A foundation system and building block for the Course and

Curriculum, and Enrollment Management systems, the Facilities Directory system allows the accurate allocation of overhead for indirect cost rate recovery. This system is a strategic necessity for the University not only in terms of cash recovery, but also legal aspects as well, such as federal guidelines for institutional research and grant expenditures.

Course and Curriculum: This system enabled the decentralization of curriculum development with each individual department being responsible for its own schedule. This system, a strategic necessity, provides a more efficient means of building course schedules in addition to aiding student advising and retention.

Student Records: A foundation system and building block for our Enrollment Management system, Student Records allows more efficient handling and production of transcripts including their follow-up. The system increases student retention by enabling the accurate and timely tracking of academic performance, thereby making it a strategic necessity for the University.

Accounts Receivable: Enabled an average daily balance-interest rate system that improved interest revenues. In addition to third party billing capabilities, this systems has fixed payment plan and deferment processors. It significantly increased cash flow and reduced our receivables balance from 90 to 60 days. It saved two FTE's and $265,000 per year, truly a strategic system.

Development and University Relations: Integrates prospect tracking with the development database, provides a full range of detailed and summary financial information. This strategic system is oriented towards institutional fund raising and is thereby proactive in nature. It has increased donations to the University of Miami by an estimated $2.7 million per year.

Recruitment and Admissions: Being heavily oriented towards marketing the University, this strategic system tracks prospective students from initial contact through the application, admission, and enrollment processes. Recruiters bring terminals and modems on their roadshows and enter data directly on the system. Timely delivery of responses, materials and answers have increased enrollment revenue at the University of Miami in excess of $1,000,000 per year.

Enrollment Management: Integrates the registration process to include housing and meal plans, academic and financial registration, and various academic support services. This system automates the full range of functions related to student registration and enables a more efficient means of completing student enrollment. It had the unforeseen benefit of improving the University's cash flow and reduced borrowing significantly beyond its original public relations value. While originally being viewed as a strategic necessity, this system has proven its competitive value as well.

Parking and Vehicle Registration: Monitors decal assignment and processing, facilitates parking fines collection, integrated with the Accounts Receivable systems and provides statistical data. This system generates revenue and has a positive impact upon the beautification of the campus by controlling the number and distribution of cars in the various parking lots. It is a strategic necessity for any institution with peripheral or on-campus parking.

Accounts Payable: Selects vouchers for automatic payment, calculates discounts automatically, provides on-line data entry and inquiry, issues checks, provides more timely and effective information reporting via on-line inquiry. By taking discounts from vendors based on payment dates, costs of goods purchased are down 2% to 5% and thus, this system has become more than a strategic necessity.

Property Accounting: Maintains inventory of all university assets, prorates both space and equipment by department, and facilitates external auditing. It calculates depreciation on capital equipment for indirect cost recovery and internal charges and is a strategic necessity.

Conclusion

Creating competitive advantage through the use of information systems is a new area of study, especially at universities. Many of the recommendations in the literature are based on untested theories, conjecture, and anecdotal evidence. Using published accounts of information systems providing competitive advantages to the owners, Boon has analyzed how these systems were developed and utilized (Boon,1988,pp.191-201). In 11 of 14 cases studied, he found systems were not initially developed with the idea of creating a competitive advantage, but rather, were intended only to improve the efficiency of internal operations. It was only later someone within the organization, and in no case was this individual an IS professional, recognized the potential for using the system to achieve broader corporate goals. Such recognition often coincided with changes in the external environment. For example, in the case of airline reservation systems, the impetus was the threat of travel agents uniting to create a reservation system independent of the airlines. This finding suggests the effort to develop new information system applications may be misguided -at least until all existing systems have been examined for potential to create a competitive advantage. For example, a computerized student registration system allowed students to register earlier and more comfortably, avoiding crowds and long lines. An unexpected end result was a better cash flow because students wanted to guarantee their course selection and therefore, paid their registration fees immediately. Incidently this enabled the University to meet its operating expenses in the latter part of the summer without having to borrow funds as was usually done. The moral of the story -sometimes you get lucky!

In his survey of the literature, Boon reports one interesting empirical finding which may be an appropriate concluding observation for this paper. In one survey, 55% of the respondents reported there was no recognized process for identifying opportunities for applying information technology. "The lack of appropriate planning, lack of top management support, difficulty in assessing tangible benefits and other priorities were major inhibitors" (Boon,1988,p.194). These results suggest any of the various suggested organizational and management concepts presented could be successful in facilitating the development of information systems which provide a competitive advantage. The important aspect is not so much the specified approach as it is the explicit recognition of the goal and development of a systematic approach to its attainment.

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T3-1
New Applications for Touchtone Systems

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New Applications for Touchtone Systems

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Administrative Data Processing
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The University of Wisconsin-Madison, the flagship campus of the University of Wisconsin System, is a land grant institution founded in 1849. The main campus covers 928 acres and includes 771 buildings. The University includes 13 schools and colleges housing 130 academic departments and over 4,700 faculty and instructional staff. In the Fall Semester 1991, 43,196 students enrolled (35,979 FTE), selecting classes from a pool of 4,418 courses.

Administrative Data Processing (ADP) is a centralized data processing office that provides computing support for administrative functions on the UW-Madison campus. The touchtone systems described in this paper run under IMS/DC on ADP's IBM 3090 mainframe computer.

In February 1985, a University Subcommittee recommended that UW-Madison develop an online registration system. The original recommendation envisioned a system where students would go to a central location and register by computer terminal. Instead, UW-Madison implemented the Touchtone Registration System, which allows students to register for courses from a touchtone phone anywhere in the country. As of 1991, all students (freshmen through graduate students) enroll for courses with this system.

Because of the success of the Touchtone Registration System and also because the touchtone hardware was not being used, the University began to examine other areas where touchtone service could be implemented for students. This paper discusses two systems that were developed for the Admissions Office and the Office of Student Financial Services to make use of the touchtone equipment.

Summer Orientation, Advising, and Registration (SOAR) Touchtone Application

Description of Undergraduate Admissions Office and SOAR

The Undergraduate Admissions Office is responsible for maintaining records for potential undergraduate applicants, from tracking prospective students to seeing new students through their first registration. The office receives and processes over 24,000 applications a year from freshmen, transfer, international, and re-entering students. Information from applications is entered, updated, and maintained for campuswide use via the ADP mainframe computer. Annually, the office handles over 200,000 pieces of mail and 100,000 phone calls. Information about the status of applications and contacts with prospective students is maintained by the Admissions Office until applicants register. Then, folders are sent to the appropriate school or college.

During the summer, UW-Madison sponsors over 40 two-day Summer Orientation, Advising and Registration Programs (SOAR) for new students planning to enter in the upcoming fall semester and their parents. The Admissions Office is responsible for implementing and managing this program. SOAR is designed to make entering the University easier for new students by providing academic advising, information on academic opportunities, and campus orientation. Faculty advisers describe program and degree requirements and help new students select a tentative course of study for the first year. Participants complete a preliminary class schedule and register for courses. The SOAR Program offers the chance to become familiar with new surroundings and to talk informally with faculty, staff, and students.

The Touchtone/Voice Response SOAR System allows eligible applicants to reserve a space in the SOAR program. Eligible applicants are new freshmen and undergraduate transfers who have been admitted for the upcoming terms. There were 31 sessions for new freshmen, 11 for transfer students and one for international students in 1991.

Background

Early in the analysis of the SOAR System, we addressed the following questions:

- How does the system tell a student the next available session?
- How can we control the number of reservations available for each session?
- How can we assign the correct session for each college advisor?
- How quickly can the tables be modified to reflect changing situations?

From these questions, we came to the conclusion that several tables were required to control access and track reservations. Two tables and two reports form the backbone of the SOAR control structure to meet the needs identified by these questions. Another question arose regarding timing within the system:

- What happens to the timing of maintenance when people on and off campus are changing the tables?

The following describes the methods used by the Touchtone/Voice Response SOAR system to control access and monitor the status of reservations. Timing considerations are discussed first, followed by a description of the tables and reports, how the SOAR staff utilizes them, and concludes with an explanation of the statistical reports. The controls used while the system is in operation are emphasized rather than the controls used to evaluate the system for future modifications.

Timing in a Dynamic Environment

Timing considerations change when combining teleprocessing and touchtone applications. In the SOAR analysis, questions like the following provided a framework for developing the touchtone application and working with timing constraints:

- How can we keep sessions available as long as possible to the callers?
- What happens when an applicant changes colleges?
- What happens when the only session an applicant can attend is unavailable?
- What happens when staff responsible for a special program promise a session to an applicant?

- When should the "Maximum Participants for a College" be increased?

We will discuss each of these considerations and explain the methods SOAR used to control the processing.

How can we keep sessions available as long as possible to the callers? To keep sessions available to callers as long as possible, the system does not hold the record that stores the number of reservations until the session number is entered by the caller. In the short time between hearing a list of available sessions, deciding which to attend, and entering a number, the session may be filled. Within the application, the session entered by the caller is checked again to see if it is still available.

What happens when an applicant changes colleges? Applicants cannot change which college they want to be admitted to through a touchtone application. The teleprocessing transaction used to maintain the applicant's college preference checks the SOAR reservation. If the new college preference is not included in the session the applicant has already reserved, the operator is notified and works with the student to reschedule the SOAR session. Once this is complete, the student may use the touchtone application to change the reservation as often as needed.

What happens when the only session an applicant can attend is not available? If the session is unavailable because the applicant's college is not scheduled in the session, the SOAR supervisor may open up the session to that college. If the session is full, the SOAR supervisor may override the maximum with a teleprocessing transaction.

How are sessions for special programs reserved? The sessions in which special programs staff participate have lower maximums in order to reserve space. Offices responsible for special programs and services to people with disabilities contact applicants and inform them of sessions when their representatives are available on site. The SOAR office receives a list of people scheduled to attend these sessions and adds them to the reservation system by a teleprocessing transaction, overriding the maximums for colleges as needed. When a student on the list has already scheduled a session for a different day, the SOAR staff notifies the office responsible for the program.

When should the Maximum Participants for a College be increased? In most cases, the maximums are increased to accommodate a student with an exceptional circumstance. Once a maximum is increased on the SOAR College File, the operator enters the reservation or asks the student to call the touchtone number. For the more popular sessions, however, the new openings may be taken by other callers already connected to the touchtone system. By the time the request that spurred the change is entered, the session may be full again. To avoid this, the SOAR supervisor enters requests for the popular sessions early in the morning before the touchtone transaction is available to the public.

Description of Tables and Reports

Record layouts of the tables and sample reports are in the Appendix for reference. The purpose of the tables is to control access and allow SOAR staff to quickly change the controls to reflect new situations. The reports provide a concise tally of the current situation in order to make decisions and to alert staff to irregularities quickly.

A SOAR session is a two-day event. Information about the complete SOAR session is maintained on the SOAR Session File. During each session one or more colleges or special program advisors are available, and the advisors will change from session to session. Information about which advisors are available during a particular session is maintained on the SOAR College File.

The description of each session is maintained on the SOAR Session File (Appendix A). This file contains the First SOAR Date; Second SOAR Date; Session Type (new freshmen, undergraduate transfers, or both); Maximum Applicants for this session; and Current Session Reservations. The information used to create the table is based on past experience and physical limitations of the accommodations. The SOAR staff estimates that for each applicant there will be 1.5 guests. With this information, the initial Maximum Applicants for this Session is calculated. The results of this calculation are simply a starting point. As reservations are made and the number of guests are finalized, the Maximum Applicants for this Session is changed to allow more people to attend.

Within each session, advisors from the different colleges are available to see applicants. Information describing when the advisors will attend SOAR and how many applicants they can see during each session is maintained on the SOAR College File (Appendix A). Each record describes the College, Session Type, SOAR Session Number, Maximum Applicants for this College, and the Current College Reservations. Each dean is asked how many applicants their advisors can see each day and what days the advisors will be available. Before the data is entered in the SOAR College File, the staff uses the 1.5 guests per applicant guide to check if the total for all the colleges exceed the Maximum Applicants for this Session from the SOAR Session File.

The two files are maintained independent of one another once the initial data is entered. While the total number of people who are allowed to reserve a session remains static, the number of people assigned to the colleges changes frequently as colleges find some sessions filling up quickly and increase the number for that session. This separate maintenance creates a situation where the total of college applicants from the SOAR College File may differ from the SOAR Session File. The report, "Reservations and Maximums Allowed by Session and College" (Appendix B) provides daily monitoring so the SOAR staff can handle discrepancies. This report is also used to monitor how sessions are filling up so the SOAR supervisor can open additional sessions, increase the maximums, or encourage applicants to reserve space in less crowded sessions.

In order to calculate the total number of people attending SOAR, the number of applicants and their guests must be added together. This is done in the last report, "SOAR Guest Count by SOAR Date" (Appendix B). It lists the number of SOAR applicants and guests for each day, along with the total. This report is printed weekly. When SOAR staff contemplate raising the maximum for a session, they can verify whether the absolute maximum for a session has been reached. This report is most useful at the end of the SOAR schedule when people are trying to register for the remaining open sessions and the SOAR supervisor must decide which sessions to open up.

Statistics

Once the SOAR schedule is finished, several statistical reports provide data about how the system worked. One lists how many applicants scheduled their initial SOAR sessions and how many changed SOAR sessions through the system. Another report lists how many times applicants placed calls to the system, information which is used to evaluate the clarity of instructions. Two reports help ADP determine the touchtone system availability: one lists the frequency of calls by time of day; the other lists the frequency of calls by date.

Summary

The touchtone SOAR system saves clerical staff time by eliminating routine data entry. In 1990, clerical staff entered approximately 6,000 requests for original reservations and changes. In 1991, the touchtone application handled 6,959 reservations and changes, while the SOAR Hotline received approximately 4,508 calls. The Hotline calls were from people who did not have touchtone phones, freshmen who wanted to check the receipt of their enrollment deposits, people trying to schedule a session when all sessions for the college were full, and some who were apprehensive about using the touchtone system.

In 1991, attendance at SOAR increased seven percent, from 86 to 93 percent participation. Part of the credit for this increase goes to touchtone SOAR system for making it easier for applicants to change their appointments. In the past, the student selected a first and second choice. If neither choice was available the SOAR office assigned a session and sent a confirmation letter. The student was required to call the office to get another session. Sometimes the student decided not to do anything further, ignoring the assigned date. By giving students control over scheduling the assignment, students are less likely to feel that their preference is unimportant.

Applicant confirmation packets consist of a parking permit, housing information, confirmation letter, and a campus map. Previously, students who rescheduled received a second complete packet. SOAR staff wondered why they used so many parking permits (7,000 were sent to 5,000 applicants). Once a week, the old system produced confirmation letters that were inserted into prepared packets. Today, the touchtone system distinguishes between applicants making reservations for the first time and those who are rescheduling. The people making first-time reservations receive the complete packet, while people changing reservations receive only confirmation letters.

In 1992, students calling the SOAR touchtone application will be able to cancel a reservation. This addition will allow students to control their schedules with no intervention from a staff member. The SOAR Hotline will continue to be available for questions.

FINFONE Touchtone Application

Description of Office of Student Financial Services and FINFONE

The Office of Student Financial Services is responsible for administering federal, state, and institutional financial aid programs, as well as providing financial aid information, financial counseling and part-time job information to students. It is among the five largest collegiate financial services offices in the nation in terms of dollars handled and applications processed. It has the largest Perkins Loan Program in the nation, one of the three largest Supplemental Educational Opportunity Grant and College Work-Study programs in the country, and is one of the most highly automated financial services offices in the nation.

During 1990-91, the Office of Student Financial Services received over 36,000 applications; of these, more than 15,000 awards were disbursed with a total value exceeding $75 million. Processing these applications involved approximately 80,000 person-to-person reception desk contacts, 66,000 reception desk phone inquiries, 8,000 individual counselor interviews, and about 9,000 other miscellaneous contacts.

Students who apply for financial aid are kept informed of their application's progress through notices sent by the Student Financial Services Office. All students who apply receive an "Acknowledgment Letter" to confirm receipt of the application. The acknowledgment also lists documentation the student must submit to complete the application. If additional information is needed later in the process, the student is sent a "Follow-up Letter" listing any new documents needed and reminding the student of documentation requested in the acknowledgment that has not been received. Once the application is complete, the student's financial need is computed, and the application is sent to a counselor for review. The counselor may need more information and will send an "Information Request" to the student detailing the specific information or additional documents required. In late spring, students who have applied on time but have not completed their applications receive a "Last Chance Letter" reminding them of the documents still needed. The last chance letter gives students a deadline for either completing the application or requesting an extension. In mid-June, qualifying students receive an "Award Notification Letter." The award notification specifies aid the student has been awarded and provides information about check disbursement. Students who have been denied aid are sent a "Denial Letter" that includes alternative resources the student may wish to pursue.

Although every effort is made to keep students informed of their applications' progress, many students remain unaware of delays until the start of the semester when they find that no aid check is waiting. Before the financial aid touchtone transaction became available, students concerned about the progress of their aid applications had to visit or call the Student Financial Services Office. Students stopping at the office would frequently have to wait in long lines before talking to someone, and students calling would often be put on hold until a staff person was available to answer questions. Student Financial Services staff would then look up the students' records using several teleprocessing (TP) transactions before being able to answer their questions. Many students' questions are not difficult, but at busy times of the year, the Student Financial Services Office is answering phones and seeing students non-stop. These busy periods occur in spring and summer when students are concerned about the status of their applications, and immediately before the fall semester when students want to know when their checks will be ready. Answering each student's questions can take several minutes, and many students are reluctant to seek assistance knowing they may have to wait.

When students contact the office, whether by phone or in person, no record of status inquiries is kept. Staff at the Student Financial Services Office are too busy answering questions to document who called and what was said. Their objective is to help as many students as they can with the limited number of staff available. Because of this, the Student Financial Services Office has no way of tracking how many students are seeking information, what information students are trying to obtain, which students are having the most problems or questions, and where the most questions and problems are being encountered in the application process.

In order to provide financial aid applicants with an easier and more convenient way to receive information about their applications, and to provide the Student Financial Services Office with more information about the students who request help, FINFONE was developed. FINFONE is a Touchtone/Voice response service that gives students information on the status of their financial aid applications and their Stafford Loan checks. With FINFONE, students concerned about their applications can get an immediate response to their questions. By offering students an easy way to monitor the progress of their applications, the Student Financial Services Office felt students would take a more active role in processing their applications. The office hoped that the number of applications completed early would increase because of FINFONE, thus increasing the number of students whose aid is ready at the beginning of the semester.

In addition to the notices currently sent out by the Student Financial Services Office, students are able to call FINFONE at their convenience to check on the progress of applications. Prior to the date when application processing starts for the upcoming semester, FINFONE provides students with information on where to pick up applications and when they may begin submitting them. After application processing has begun, FINFONE tells students of the deadline for receiving applications at the Student Financial Services Office. As individual applications are processed, FINFONE keeps each student up to date on the status of the application. For example, FINFONE tells the student which forms must be submitted to complete the application, when the application is being reviewed, when an information request has been sent, when all documentation has been received but the student has not yet been admitted, when the application has been cancelled and the reason for the cancellation, and when an award notification has been sent and the date it must be returned. If a student is awarded a Stafford Loan, FINFONE tells the student when the checks will be available, when an Entrance Interview must be attended, and for first time Stafford Loan borrowers, that the checks may be picked up only after the government-mandated, 30-day delay.

With each call to FINFONE, various statistics about the call are logged so the Student Financial Services Office and ADP can monitor usage of the transaction. Each log shows the student's ID, the date and time of the call, the application progress indicator (status) at the time of the call, the student's year in school and classification at the time of the call, and a response code indicating which messages FINFONE gave the student. Several reports have been created to allow the Student Financial Services Office and ADP track the type and number of students calling. With these reports, the Student Financial Services Office can use the log information to improve office procedures. Reports by student class level (Appendix C) tell the Student Financial Services Office which students are most concerned about the progress of their application. Reports by student status (Appendix D) show at what point in the process students are inquiring about the status of their application. ADP uses the information to monitor system usage to help make decisions for future touchtone requirements. The report showing the times and number of student calls (Appendix E) help ADP allocate touchtone system resources appropriately.

Summary

Since January 1991, when FINFONE was first made available for student use, approximately 18,000 calls have been received. The calls have led to changes in both Student Financial Services Office procedures, and changes in the way data for them is stored.

After students complete applications, the application folders are sent to counselors who review computer-generated Need Analysis Reports for accuracy. With the large number of applications completed during the summer, counselors sometimes get behind in their reviews. Students calling the office during the summer to check on their application receive a "Status Check" if the application has been complete for more than four weeks. A status check is a procedure that puts a higher priority on completing the review of an individual application. The student is assured with a status check that the Student Financial Services Office will reach a decision and send a notice seven to ten days from the date the student called.

Students calling FINFONE alone did not prompt the Student Financial Services Office to perform a status check since the process must be initiated by a staff person looking at a student's record. Because of a report from FINFONE showing the number of times individual students call each week, the Student Financial Services Office augmented its procedure for doing status checks. The Student Financial Services Office decided that anyone who called FINFONE more than once in a week and who would normally qualify for a status check would get one. Because of the concern shown by these students, the Student Financial Services Office decided to improve the service for them by assuring them that they would receive a decision as soon as possible.

ADP changed the way data for the Student Financial Services Office is stored because FINFONE did not have access to complete information on citizenship verification. Tracking a student's citizenship had always been kept on two different files. The financial services document file contained information on when the citizenship verification document was needed and when the document had been received from the student. The financial services anecdotal file contained free-form text about when the citizenship document was sent to and returned from the Immigration and Naturalization Service (INS). Because of the desire to give students the most accurate information possible on FINFONE, tracking INS processing of the citizenship verification document was moved to the financial services document file. Now when a student submits the citizenship verification, a flag is set on the document file to show it was sent to the INS. Once the INS returns the document, the flag is changed to show that the student has fulfilled the citizenship verification requirements. One message is given to the student prior to the student submitting the verification form, and another message is given when the verification is sent to the INS. After the document is returned from the INS, the message about this document is no longer given.

Future Enhancements

As students continue to use FINFONE, Student Financial Services will modify office procedures to make the application process easier. One enhancement already being developed is providing the status of all financial aid checks. As a result of student and staff comments, other plans include applying for financial aid by phone, requesting an application packet, providing cumulative loan debt information, providing cumulative work-study earnings, making an appointment to see a counselor, checking the status of an appeal, requesting a Financial Aid Transcript, and giving student loan balances.

Conclusion

The SOAR and FINFONE applications allow the University to make use of touchtone equipment for a greater part of the year. These two applications have allowed us to partially realize our goal of providing additional touchtone services to students. As more touchtone applications are developed, students will find the campus more accessible with services waiting at their fingertips.

Appendix A

SOAR Session File Record

SOAR Session Number	2-character number assigned to each SOAR date
First Soar Date	CCYYMMDD format
Second Soar Date	CCYYMMDD format
Session Type	New Freshmen = 1 Transfer = 2 Both = 3
Maximum Applicants for this Session	
Current Session Reservations	

SOAR College File Record

College	College plus an asterisk
Session Type	New Freshman = 1 Transfer = 2
SOAR Session Number	2-character number assigned to each SOAR date
Maximum Applicants for this College	Maximum attendees for this college
Current College Reservations	Current reservations for this college

APPENDIX B

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10/21/91                     UW-MADISON UNDERGRADUATE ADMISSIONS SYSTEM
AD6900                          RESERVATIONS AND MAXIMUMS ALLOWED
                                  BY SESSION AND COLLEGE

SOAR                                                                          FIRST       SOAR    SOAR
SESSION   (-*)   (4*)   (2*)   (3*)   (0*)   (8*)   (7*)   (1*)   (A*)   SOAR        CLASS   SESS
NUMBER    L&S    ENGR   BUS    EDUC   ALS    PHM    NUR    FRCS   MED    DATE        TOTAL   TOTL    MESSAGES

01 CURR   66     21     21      9      7      5      3      2      2     06/16/91    136     136
01 MAX    69     21     24      9      9      6      3      3      2                 146     146

02 CURR   56     16     23      9     10      5      3      3      2     06/17/91    127     120     ERROR
02 MAX    64     16     26      9     10      6      3      3      2                 139     139

03 CURR   63     21     22      8      9      5      3      2      2     06/18/91    135     135
03 MAX    71     22     24     10      9      6      3      3      2                 150     140     ERROR

04 CURR   70     21     14      9      8      6      2      3      2     06/19/91    135     150
04 MAX    69     21     24      9      9      6      3      3      2                 146     146

          255    79     80     35     34     21     11     10      8                 533     541
          273    80     98     37     37     24     12     12      8                 581     571
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10/21/91                  UW-MADISON UNDERGRADUATE ADMISSIONS SYSTEM          PAGE 1
AD6251                      NUMBER OF SOAR PARTICIPANTS AND GUESTS
                              BY DATE WITH SOAR SESSION NUMBERS

FIRST        SOAR
SOAR         SESSION      SESSION      SOAR              NUMBER OF
DATE         NUMBER       TYPE         PARTICIPANTS      SOAR GUESTS          TOTAL

06/19/91     01           T            136                60                  196

06/17/91     02           F            127               201                  327

06/18/91     03           F            135               155                  290

06/19/91     04           F            135               178                  313

TOTAL        TOTAL                     533               594                  1,127
```

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(Appendix C)

UNIVERSITY OF WISCONSIN - MADISON
OFFICE OF STUDENT FINANCIAL SERVICES
NUMBER OF CALLS BY LEVEL
FROM CALLS MADE IN 1991

YEAR	LEVEL	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1992	UNKNOWN	89	349	503	848	310	132	112	57	13	17	0	0	2,430
	FRESHMAN	19	127	213	610	564	286	272	428	286	147	0	0	2,952
	SOPHOMORE	16	139	203	618	679	282	313	530	434	80	0	0	3,294
	JUNIOR	16	97	170	536	721	366	311	611	575	168	0	0	3,571
	SENIOR	20	78	136	430	746	472	453	804	589	155	0	0	3,883
	GRAD	41	76	139	267	416	280	239	603	619	108	0	0	2,788
	MED	3	5	10	25	58	21	31	22	12	10	0	0	197
	VET	5	5	9	19	39	15	5	45	20	4	0	0	166
	LAW	0	45	50	77	146	82	48	151	133	18	0	0	750
	SPECIAL	0	2	5	5	12	3	2	23	20	2	0	0	74
		209	923	1,438	3,435	3.691	1,939	1,786	3.274	2,701	709	0	0	20105

(Appendix D)

UNIVERSITY OF WISCONSIN - MADISON
OFFICE OF STUDENT FINANCIAL SERVICES
STATUS OF CALLERS
FROM CALLS MADE IN 1991

YEAR	STATUS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1992	NOF	43	43	16	9	12	4	4	3	3	2	0	0	139
	08	30	53	39	17	11	0	3	3	7	5	0	0	168
	10	0	0	21	75	125	32	19	42	20	10	0	0	344
	17	0	0	0	6	18	25	43	46	39	19	0	0	196
	18	0	0	0	51	142	162	67	92	41	9	0	0	564
	19	0	0	0	34	131	34	19	17	7	3	0	0	245
	21	0	0	0	0	8	30	41	25	18	5	0	0	127
	25	0	0	0	30	30	42	35	37	25	11	0	0	210
	29	0	0	3	9	11	5	2	6	2	0	0	0	38
	30	58	420	652	1,167	1,524	326	223	317	145	67	0	0	4,899
	31	0	0	37	434	882	602	522	442	233	94	0	0	3,246
	32	0	0	32	79	104	21	24	28	2	2	0	0	292
	33	0	0	0	12	24	18	23	8	13	4	0	0	102
	34	0	0	0	0	0	72	28	69	28	5	0	0	202
	35	0	0	0	32	56	90	70	92	71	31	0	0	442
	50	0	0	0	17	91	293	331	236	208	56	0	0	1,232
	55	0	0	0	1	43	122	248	621	826	221	0	0	2,082
	56	0	0	0	1	0	10	21	22	7	2	0	0	63
	60	0	0	0	0	0	0	0	781	323	37	0	0	1,141
	65	0	0	0	0	0	9	18	362	683	119	0	0	1,191
	81	0	0	0	6	25	18	12	0	0	0	0	0	61
	82	0	0	0	1	0	0	0	0	0	0	0	0	1
	90	2	1	1	13	14	25	26	6	0	0	0	0	88
	91	0	0	0	2	4	0	4	0	0	0	0	0	10
	92	0	0	0	0	0	4	7	0	0	0	0	0	11
	93	0	0	0	0	0	0	71	26	0	2	0	0	99
	95	0	0	0	1	3	15	6	3	0	0	0	0	28
	96	0	0	0	0	8	4	6	6	0	5	0	0	29
	98	0	0	0	0	0	0	5	3	0	0	0	0	8
	99	0	0	0	0	0	0	8	1	0	0	0	0	9
		133	517	801	1,997	3,266	1,963	1,886	3,294	2,701	709	0	0	17267

(Appendix E)

UNIVERSITY OF WISCONSIN - MADISON
OFFICE OF STUDENT FINANCIAL SERVICES
NUMBER OF CALLS PER HOUR
FROM CALLS MADE IN 1991

CALL HOUR	NUMBER OF CALLS	CUMULATIVE CALLS
6:00 a.m.	19	19
7:00 a.m.	581	600
8:00 a.m.	1,203	1,803
9:00 a.m.	1,567	3,370
10:00 a.m.	1,813	5,183
11:00 a.m.	1,817	7,000
12:00 p.m.	1,875	8,875
1:00 p.m.	1,772	10,647
2:00 p.m.	1,728	12,375
3:00 p.m.	1,704	14,079
4:00 p.m.	1,558	15,637
5:00 p.m.	906	16,543
6:00 p.m.	335	16,878
7:00 p.m.	4	16,882

37th Annual College and University
Computer Users Conference

"Discover New Worlds With Technology"

T3-2

Iowa State University's New Guaranteed Student Loan System: Featuring Relational Databases, Electronic Data, and Electronic Funds Transfer

Larry Newhouse
Roberta Johnson
Wayne Ostendorf
Iowa State University

Iowa State University's NEW Guaranteed Student Loan System: Featuring Relational Databases, Electronic Data, and Electronic Funds Transfer

Roberta Johnson
Assistant Director, Financial Aid Office
Iowa State University

Larry Newhouse
Lead Systems Analyst, ADP Center
Iowa State University

Wayne Ostendorf
Director, ADP Center
Iowa State University

The Iowa State University Financial Aid Office and Administrative Data Processing Center have developed and implemented a sophisticated, relational data-based system to help handle the tremendous workloads involved in processing loans, tracking the receipt of funds, maintaining audit compliance, and increasing accuracy while reducing the turn-around time for handling a transaction. Many factors, including state agency regulations, lenders' needs, accounting requirements, electronic communication, and integration with existing systems, led to the decision to develop our own Interactive Student Loan System. This system meets the needs of a student body of approximately 25,100 and allows the ISU Student Financial Aid Office to process loans totalling $35 million, involving more than 100,000 documents and records that are processed in administering and distributing these funds.

Iowa State University, located in Ames, Iowa, has had a history of developing quality computerized solutions for meeting its administrative needs. This project continues in that vein, with the Student Loan System being integrated with the many other systems that share student and financial information.

Overview

This paper begins with a brief background of loan processing at Iowa State and then details the improvements resulting from the implementation of a new, interactive loan system. The appendix on page 14 discusses the system that the interactive system replaces. The discussion of both systems covers

- Application Processing.
- Application Information Transfer.
- Funds Receipt.
- Funds Application.

Background of Loan Processing at Iowa State University

As at other schools nationally, Guaranteed Student Loans at Iowa State University have become increasingly important options for financing college costs. When the federal government began phasing out of the Federally Insured Student Loan Program (FISLP) in the late 1970's, the state of Iowa reacted by providing these loans to students attending state institutions. In 1979, a total of 6,810 student loan applications were processed by Iowa State University. With the advent of a state-administered program and a change in federal regulations, this number increased to 11,634 by 1980. During the early 1980's the number of students receiving these loans continued to grow until 1986, when nearly 16,000 student loan applications were received and reviewed by staff. By July 1986, these applications represented a yearly loan program volume of $23.5 million.

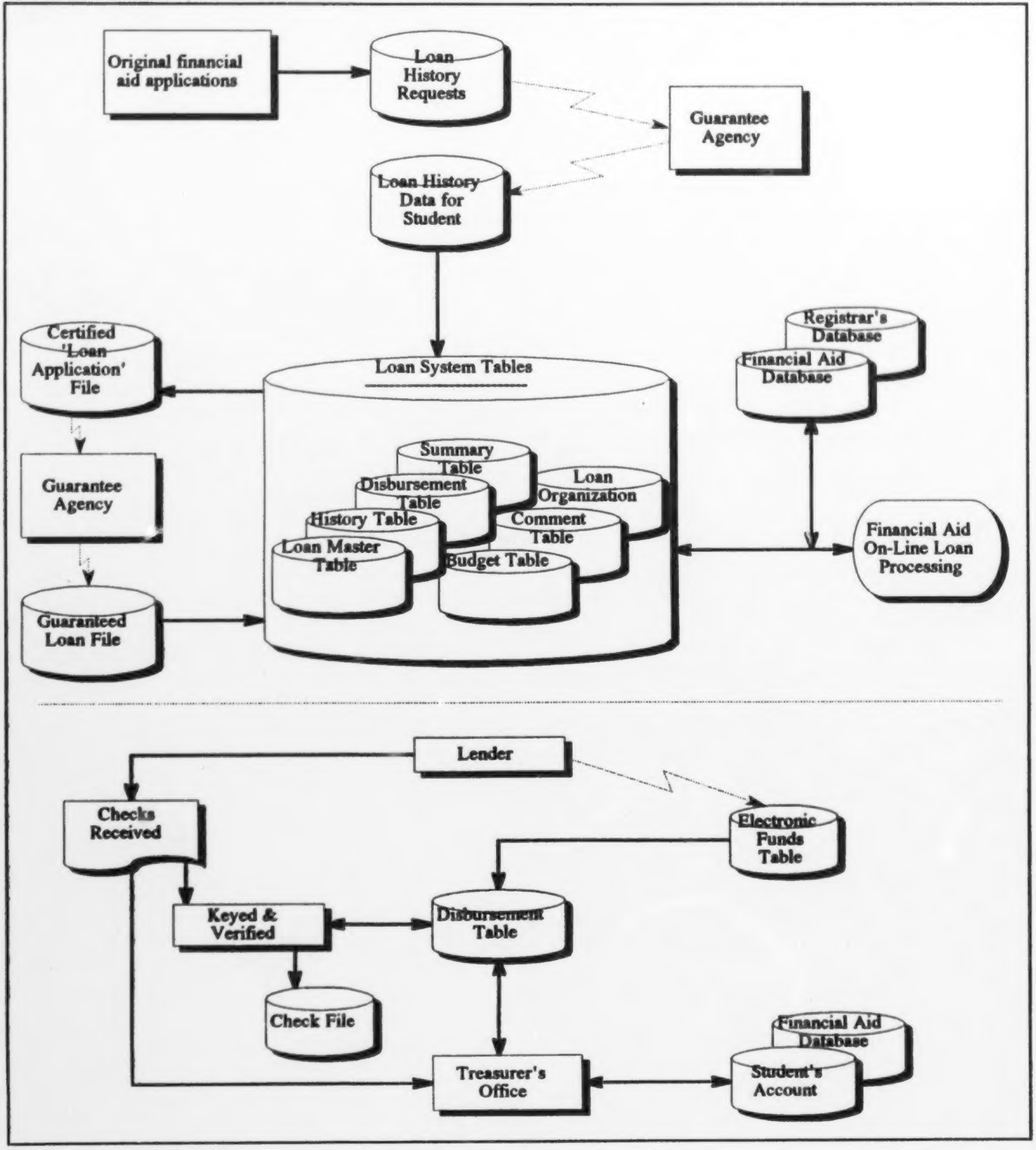
In 1986, the federal government reacted to growing concerns over the default rate in the student loan programs by enacting legislation to restrict the student loan programs. While access to the program became more stringent, loan limits were increased such that no real decrease in dollar volume was experienced. However, along with these regulations came additional requirements for school personnel to ensure that debt management was addressed, both prior to receipt of the funds and when the student left school.

By 1990, the size of the loan programs at ISU had increased to $35 million. Shrinking university funding restricted the hiring of additional staff to handle the burden of complying with the federal regulations while maintaining adequate turn-around time in processing student loans. With these problems in mind, the Student Financial Aid Office and the Administrative Data Processing Office set out to develop the Interactive Guaranteed Student Loan System. The goal was to develop a system to process loans, track receipt of funds, maintain audit compliance, and increase accuracy and turn-around time.

The Interactive Guaranteed Student Loan System

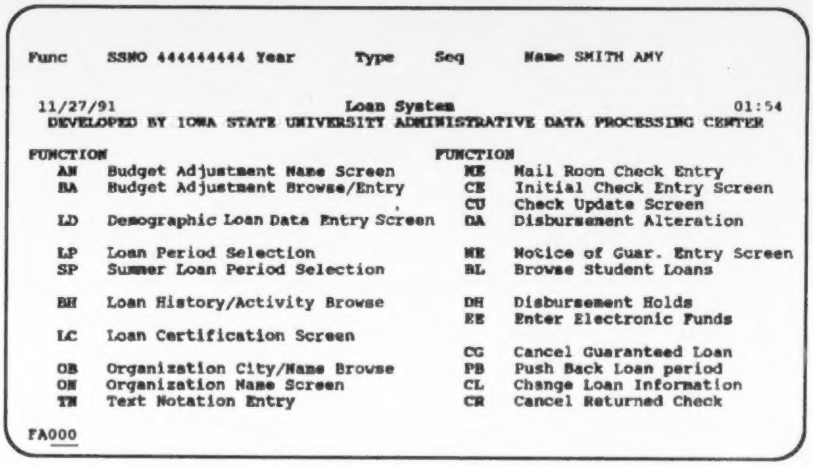
In the context of the background just described and that presented in the appendix on page 14, the general goals in developing and implementing the new, interactive system were to enhance student services, reduce staff workloads, reduce errors, monitor funds more effectively, and help control departmental expenses. To meet these goals, the Interactive Guaranteed Student Loan System is a multi-faceted system that features electronic funds transfer, shares data with other university systems, and takes advantage of techniques that minimize data entry. The flowchart in Figure 1 shows the relationships and the general flow of information between the various elements of the system.

Figure 1
System Flowchart


Original financial aid applications
Loan History Requests
Guarantee Agency
Loan History Data for Student
Certified 'Loan Application' File
Loan System Tables
Registrar's Database
Financial Aid Database
Summary Table
Disbursement Table
Loan Organization
History Table
Comment Table
Loan Master Table
Budget Table
Guarantee Agency
Financial Aid On-Line Loan Processing
Guaranteed Loan File
Lender
Checks Received
Electronic Funds Table
Keyed & Verified
Disbursement Table
Check File
Financial Aid Database
Treasurer's Office
Student's Account

The general menu of the system, seen in Figure 2, shows the range of features the system offers.

Figure 2
Loan System Main Menu



```
Func    SSNO 444444444 Year      Type    Seq      Name SMITH AMY

 11/27/91                      Loan System                          01:54
  DEVELOPED BY IOWA STATE UNIVERSITY ADMINISTRATIVE DATA PROCESSING CENTER

FUNCTION                                  FUNCTION
   AN   Budget Adjustment Name Screen        ME   Mail Roon Check Entry
   BA   Budget Adjustment Browse/Entry       CE   Initial Check Entry Screen
                                             CU   Check Update Screen
   LD   Demographic Loan Data Entry Screen   DA   Disbursement Alteration

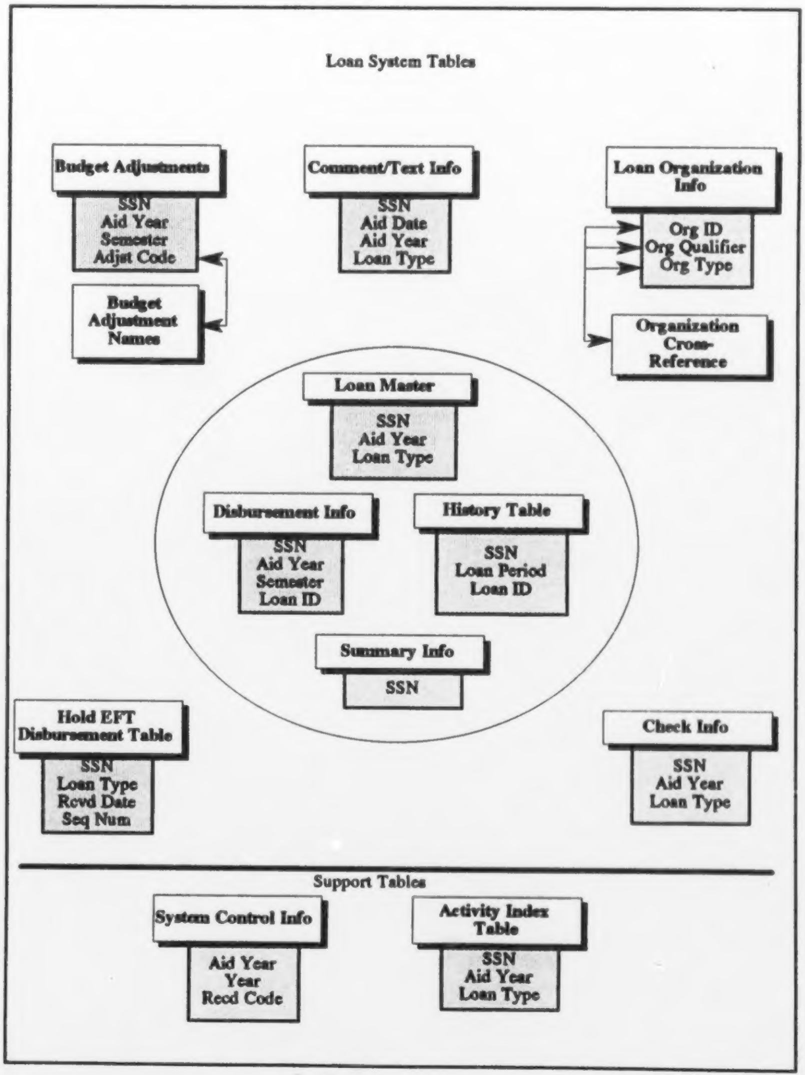
   LP   Loan Period Selection                NE   Notice of Guar. Entry Screen
   SP   Summer Loan Period Selection         BL   Browse Student Loans

   BH   Loan History/Activity Browse         DH   Disbursement Holds
                                             EE   Enter Electronic Funds
   LC   Loan Certification Screen
                                             CG   Cancel Guaranteed Loan
   OB   Organization City/Name Browse        PB   Push Back Loan period
   ON   Organization Name Screen             CL   Change Loan Information
   TN   Text Notation Entry                  CR   Cancel Returned Check

FA000
```

Figure 3
Loan System Tables

The Loan Master, Disbursement, Summary, and History tables make up the central databases. These are maintained by social security number, aid year, and loan type: Stafford, Supplemental Loan for Students (SLS), and Parent Loan for Undergraduate Students (PLUS). The Budget Adjustment, Comment, Check Information, and Hold EFT (Electronic Funds Transfer) tables provide additional data for processing the loan. The Loan Organization table contains information on lenders and guaranteeing agencies. The System Control and Activity tables provide supporting information to the loan process.

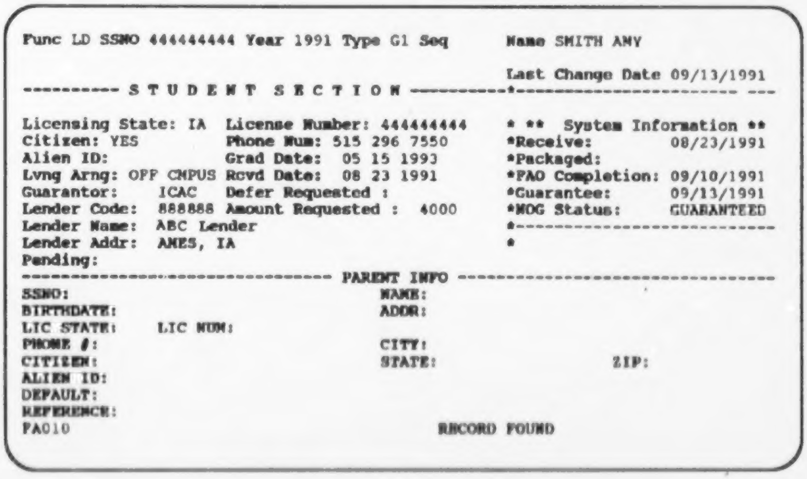

Loan System Tables
Budget Adjustments
SSN
Aid Year
Semester
Adjst Code
Budget Adjustment Names
Comment/Text Info
SSN
Aid Date
Aid Year
Loan Type
Loan Organization Info
Org ID
Org Qualifier
Org Type
Organization Cross-Reference
Loan Master
SSN
Aid Year
Loan Type
Disbursement Info
SSN
Aid Year
Semester
Loan ID
History Table
SSN
Loan Period
Loan ID
Summary Info
SSN
Hold EFT Disbursement Table
SSN
Loan Type
Rcvd Date
Seq Num
Check Info
SSN
Aid Year
Loan Type
Support Tables
System Control Info
Aid Year
Year
Recd Code
Activity Index Table
SSN
Aid Year
Loan Type

Application Processing

In the new system, the loan process is broken down into a series of steps, each with its own screen to direct the thought process of the loan processor. With these screens, the time required to process a loan application has been reduced to a maximum of two minutes, primarily because the system makes the critical decisions, and the operator has only to select from the available options.

The first screen, called the Loan Demographic Screen (LD), appears in Figure 4. This screen allows the staff to load on the receipt of an application with demographic information found on the application form. If problems exist, a pending notation can be made and the application routed appropriately for resolution of the difficulty. The dollar amount that the student requests on the application form is loaded onto this screen, and this amount controls the amount that can later be approved for the borrower.

Figure 4
Loan Demographic Screen



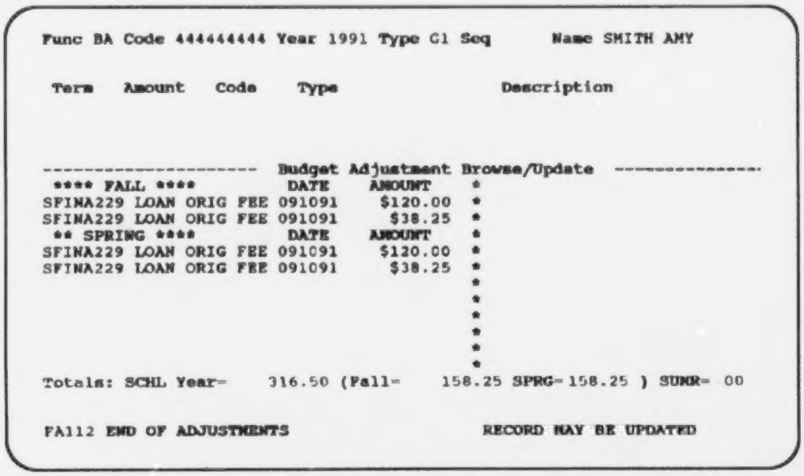
```
Func LD SSNO 444444444 Year 1991 Type G1 Seq       Name SMITH AMY

                                                   Last Change Date 09/13/1991
---------- S T U D E N T  S E C T I O N ----------*---------------------- ---

Licensing State: IA  License Number: 444444444    * **  System Information **
Citizen: YES         Phone Num: 515 296 7550      *Receive:          08/23/1991
Alien ID:            Grad Date:  05 15 1993       *Packaged:
Lvng Arng: OFF CMPUS Rcvd Date:  08 23 1991       *FAO Completion: 09/10/1991
Guarantor:     ICAC  Defer Requested :            *Guarantee:        09/13/1991
Lender Code:  888888 Amount Requested :  4000     *MOG Status:       GUARANTEED
Lender Name:  ABC Lender                          *---------------------------
Lender Addr:  AMES, IA                            *
Pending:
-------------------------------- PARENT INFO --------------------------------
SSNO:                                 NAME:
BIRTHDATE:                            ADDR:
LIC STATE:    LIC NUM:
PHONE #:                              CITY:
CITIZEN:                              STATE:                  ZIP:
ALIEN ID:
DEFAULT:
REFERENCE:
FA010                                           RECORD FOUND
```

The second screen, an optional screen, allows staff to adjust the student's expense budget. Increases in the expense budget allow the borrower increased eligibility in the student loan program. Changes made on this screen are automatically transferred to other parts of the Student Financial Aid computer system because the changes affect other financial aid programs. Tracking the source of the budget adjustment for audit purposes is maintained on this screen. The breakdown of the adjustment by term also allows staff to control how budget adjustments are used in processing student loans. Figure 5 shows this screen, called the Budget Adjustment (BA) Screen.

Figure 5
Budget Adjustment Screen



```
Func BA Code 444444444 Year 1991 Type G1 Seq       Name SMITH AMY

 Term   Amount   Code    Type                  Description

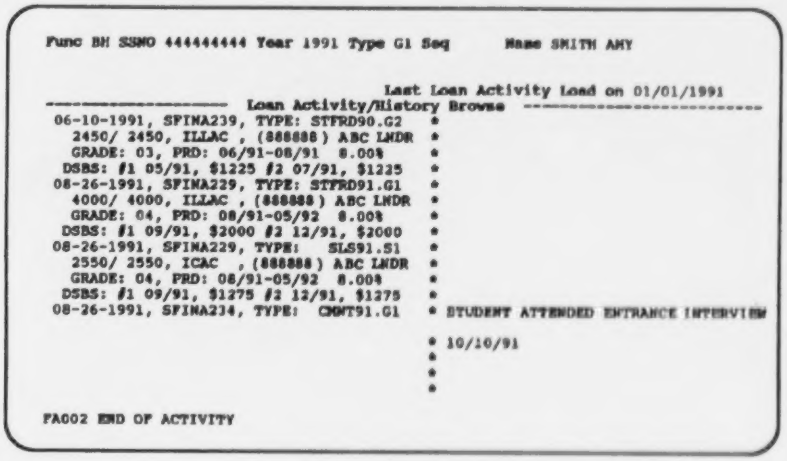


--------------------- Budget Adjustment Browse/Update -------------
 **** FALL ****          DATE    AMOUNT    *
SFINA229 LOAN ORIG FEE 091091     $120.00  *
SFINA229 LOAN ORIG FEE 091091      $38.25  *
 ** SPRING ****          DATE    AMOUNT    *
SFINA229 LOAN ORIG FEE 091091     $120.00  *
SFINA229 LOAN ORIG FEE 091091      $38.25  *
                                           *
                                           *
                                           *
                                           *
                                           *
                                           *
Totals: SCHL Year=    316.50 (Fall=    158.25 SPRG= 158.25 ) SUMR= .00

FA112 END OF ADJUSTMENTS                     RECORD MAY BE UPDATED
```

The Loan History (BH) Screen, seen in Figure 6, was developed in cooperation with the Iowa College Student Aid Commission (ICSAC) and their servicer, United Student Aid Funds. At the time a student first applies for financial aid, a request for loan history is generated and transmitted to the guarantee agency. The loan history is returned electronically. Our loan history data is then updated and can be used in determining loan eligibility when an application is processed for a new loan. The history screen has also proved to be a powerful tool in debt management counseling. Using this screen, staff from the Student Financial Aid Office can access the borrower's record and counsel the student regarding the implications of future debt.

Figure 6
Browse History Screen



```
Func BH SSNO 444444444 Year 1991 Type G1 Seq       Name SMITH AMY

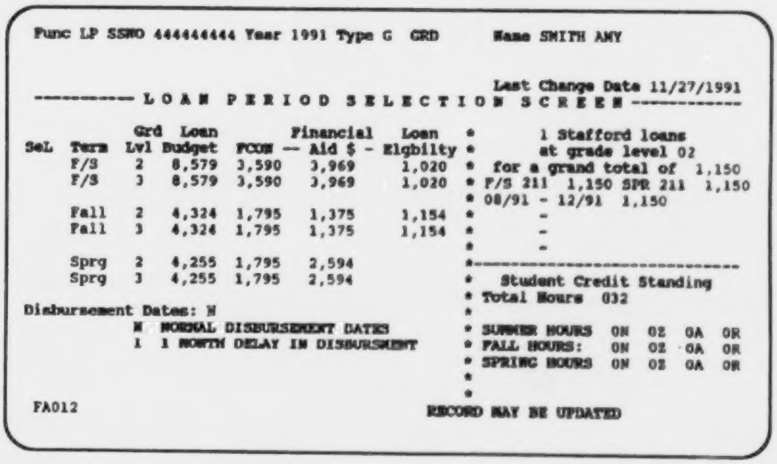
                                       Last Loan Activity Load on 01/01/1991
------------------- Loan Activity/History Browse -----------------------
 06-10-1991, SFINA239, TYPE: STFRD90.G2  *
   2450/ 2450, ILLAC , (888888) ABC LNDR  *
   GRADE: 03, PRD: 06/91-08/91  8.00%     *
  DSBS: #1 05/91, $1225 #2 07/91, $1225   *
 08-26-1991, SFINA229, TYPE: STFRD91.G1   *
   4000/ 4000, ILLAC , (888888) ABC LNDR  *
   GRADE: 04, PRD: 08/91-05/92  8.00%     *
  DSBS: #1 09/91, $2000 #2 12/91, $2000   *
 08-26-1991, SFINA229, TYPE:   SLS91.S1   *
   2550/ 2550, ICAC  , (888888) ABC LNDR  *
   GRADE: 04, PRD: 08/91-05/92  8.00%     *
  DSBS: #1 09/91, $1275 #2 12/91, $1275   *
 08-26-1991, SFINA234, TYPE:  CMNT91.G1   * STUDENT ATTENDED ENTRANCE INTERVIEW

                                          * 10/10/91
                                          *
                                          *
                                          *

FA002 END OF ACTIVITY
```

The Loan Period (LP) Screen, displayed below in Figure 7, is the main decision-making screen in the system. On this screen, the loan processor is required to choose which loan period the loan is intended to cover, the grade level the borrower has attained for the loan period, and whether or not it is necessary to delay release of the funds due to the student's status as a new borrower. To assist in this decision making process, this screen also displays the most recent loans the borrower has obtained at the same grade level, which may affect the present loan, and shows information from the Registrar's system, which indicates the student's grade level. The loan processor has only to select the loan period/grade level based on this information before moving to the next screen.

Figure 7
Loan Period Screen



```
Func LP SSNO 444444444 Year 1991 Type G  GRD      Name SMITH AMY

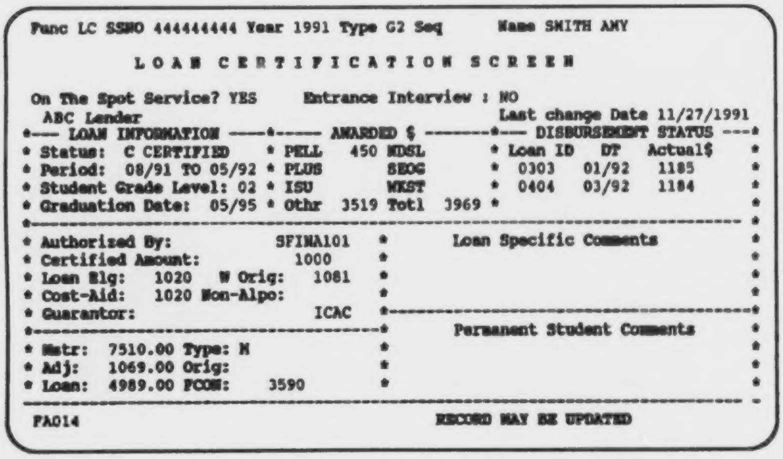
                                                Last Change Date 11/27/1991
---------- L O A N  P E R I O D  S E L E C T I O N  S C R E E N ----------

          Grd  Loan           Financial    Loan  *       1 Stafford loans
SeL  Term Lvl Budget  FCON -- Aid $ - Elgbilty *       at grade level 02
     F/S   2   8,579  3,590   3,969     1,020  *  for a grand total of  1,150
     F/S   3   8,579  3,590   3,969     1,020  * F/S 211  1,150 SPR 211  1,150
                                               * 08/91 - 12/91  1,150
     Fall  2   4,324  1,795   1,375     1,154  *       -
     Fall  3   4,324  1,795   1,375     1,154  *       -
                                               *       -
     Sprg  2   4,255  1,795   2,594            *-----------------------------
     Sprg  3   4,255  1,795   2,594            *   Student Credit Standing
                                               * Total Hours  032
Disbursement Dates: N                          *
           N  NORMAL DISBURSEMENT DATES        * SUMMER HOURS  ON  0Z  0A  0R
           1  1 MONTH DELAY IN DISBURSMENT     * FALL HOURS:   ON  0Z  0A  0R
                                               * SPRING HOURS  ON  0Z  0A  0R
                                               *
                                               *
FA012                                     RECORD MAY BE UPDATED
```

The final screen used in processing the loan application is the Loan Certification (LC) Screen shown in Figure 8. Only four pieces of information are loaded on this screen.

- The first, a question about On-the-Spot Processing, allows Student Financial Aid Administrators to receive data about the use of this service.
- The second, a question about Entrance Interviews, allows staff to indicate to the system that the borrower must attend an entrance interview in order to comply with federal regulations regarding this requirement. Information loaded in this field will be transferred to another screen when the funds are approved.
- The third field that is loaded is the status field. Every loan approved by a loan processor is set to a "certified" status. This status is critical to the remainder of the application process and is the indicator that the loan can be transmitted to the guarantee agency.
- Finally, the certified loan amount is entered. The amount entered in this field cannot exceed the maximum amount the student is eligible to receive, as calculated and displayed on the LC Screen, or the amount the student requested, whichever is less.

Figure 8
Loan Certification Screen



```
Func LC SSNO 444444444 Year 1991 Type G2 Seq      Name SMITH AMY

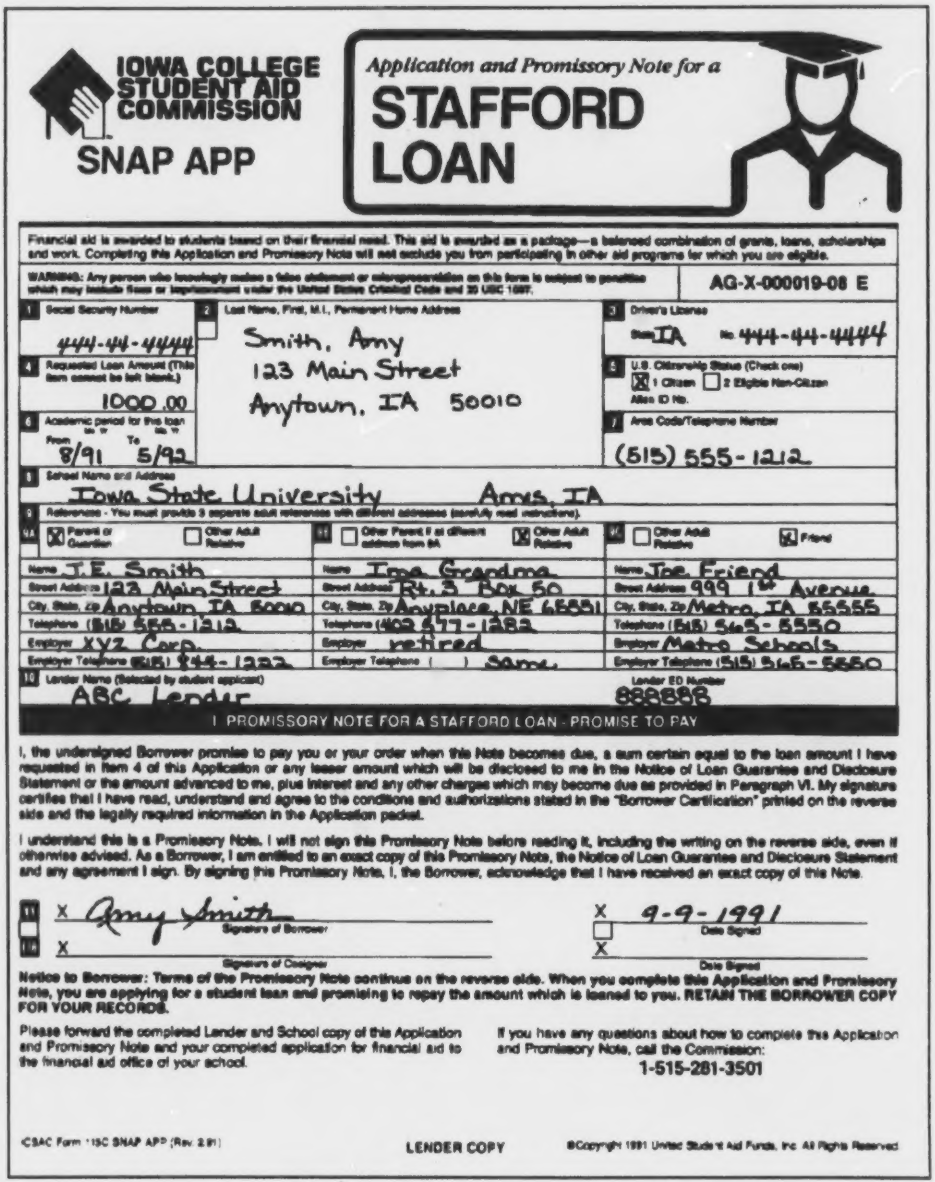
         L O A N  C E R T I F I C A T I O N  S C R E E N

On The Spot Service? YES     Entrance Interview : NO
 ABC Lender                                     Last change Date 11/27/1991
*--- LOAN INFORMATION ----*----- AWARDED $ -------*--- DISBURSEMENT STATUS ---*
* Status:  C CERTIFIED    * PELL   450 NDSL       * Loan ID   DT   Actual$    *
* Period:  08/91 TO 05/92 * PLUS       SEOG       *  0303   01/92   1185      *
* Student Grade Level: 02 * ISU        WKST       *  0404   03/92   1184      *
* Graduation Date:  05/95 * Othr  3519 Totl  3969 *                           *
*--------------------------------------------------------------------------- *
* Authorized By:            SFINA101  *       Loan Specific Comments          *
* Certified Amount:           1000    *                                       *
* Loan Elg:   1020   W Orig:   1081   *                                       *
* Cost-Aid:   1020 Non-Alpo:          *                                       *
* Guarantor:                  ICAC    *---------------------------------------*
*-------------------------------------*       Permanent Student Comments      *
* Mstr:  7510.00 Type: M              *                                       *
* Adj:   1069.00 Orig:                *                                       *
* Loan:  4989.00 PCON:     3590       *                                       *
--------------------------------------------------------------------------- -
FA014                                   RECORD MAY BE UPDATED
```

Application Information Transfer

Iowa State University decided to adopt a shortened application form, endorsed by the guarantee agency, known as the "Snap App." Figure 9, below, shows an example of the "Snap App" form. This change was made to reduce the turnaround time and also to reduce errors encountered from loan processors recopying information from the computer system onto the loan application form, which would later be key-entered at the guarantee agency. On the Snap App, the student loan borrower completes the demographic information, and the school electronically transmits this information to the guaranteeing agency. Since 99% of the student loans processed at Iowa State University are guaranteed by the Iowa College Student Aid Commission, and since 75% of their lenders have agreed to participate in the Accelerated Loan Processing Option (ALPO), which is necessary to support an electronic transmission of data, the decision to use the Snap App form has greatly enhanced turnaround time.

Figure 9
Example of a completed "Snap App."



IOWA COLLEGE STUDENT AID COMMISSION

SNAP APP

Application and Promissory Note for a

STAFFORD LOAN

Financial aid is awarded to students based on their financial need. This aid is awarded as a package—a balanced combination of grants, loans, scholarships and work. Completing this Application and Promissory Note will not exclude you from participating in other aid programs for which you are eligible.

WARNING: Any person who knowingly makes a false statement or misrepresentation on this form is subject to penalties which may include fines or imprisonment under the United States Criminal Code and 20 USC 1097.

AG-X-000019-08 E

1 Social Security Number: 444-44-4444

2 Last Name, First, M.I., Permanent Home Address:
Smith, Amy
123 Main Street
Anytown, IA 50010

3 Driver's License: State IA No. 444-44-4444

4 Requested Loan Amount (This item cannot be left blank.): 1000.00

5 U.S. Citizenship Status (Check one): ☒ 1 Citizen ☐ 2 Eligible Non-Citizen Alien ID No.

6 Academic period for this loan (Mo Yr): From 8/91 To 5/92

7 Area Code/Telephone Number: (515) 555-1212

8 School Name and Address: Iowa State University Ames, IA

9 References - You must provide 3 separate adult references with different addresses (carefully read instructions).

9A	9B	9C
☒ Parent or Guardian ☐ Other Adult Relative	☐ Other Parent if at different address from 9A ☒ Other Adult Relative	☐ Other Adult Relative ☒ Friend
Name J.E. Smith	Name Ima Grandma	Name Joe Friend
Street Address 123 Main Street	Street Address Rt. 3 Box 50	Street Address 999 1st Avenue
City, State, Zip Anytown IA 50010	City, State, Zip Anyplace, NE 65551	City, State, Zip Metro, IA 55555
Telephone (515) 555-1212	Telephone (402) 577-1282	Telephone (515) 565-5550
Employer XYZ Corp.	Employer retired	Employer Metro Schools
Employer Telephone (515) 844-1222	Employer Telephone ( ) Same	Employer Telephone (515) 566-5550

10 Lender Name (Selected by student applicant): ABC Lender

Lender ED Number: 888888

I PROMISSORY NOTE FOR A STAFFORD LOAN - PROMISE TO PAY

I, the undersigned Borrower promise to pay you or your order when this Note becomes due, a sum certain equal to the loan amount I have requested in Item 4 of this Application or any lesser amount which will be disclosed to me in the Notice of Loan Guarantee and Disclosure Statement or the amount advanced to me, plus interest and any other charges which may become due as provided in Paragraph VI. My signature certifies that I have read, understand and agree to the conditions and authorizations stated in the "Borrower Certification" printed on the reverse side and the legally required information in the Application packet.

I understand this is a Promissory Note. I will not sign this Promissory Note before reading it, including the writing on the reverse side, even if otherwise advised. As a Borrower, I am entitled to an exact copy of this Promissory Note, the Notice of Loan Guarantee and Disclosure Statement and any agreement I sign. By signing this Promissory Note, I, the Borrower, acknowledge that I have received an exact copy of this Note.

11 X Amy Smith — Signature of Borrower — X 9-9-1991 — Date Signed

☐

11 X ____ — Signature of Cosigner — X ____ — Date Signed

Notice to Borrower: Terms of the Promissory Note continue on the reverse side. When you complete this Application and Promissory Note, you are applying for a student loan and promising to repay the amount which is loaned to you. RETAIN THE BORROWER COPY FOR YOUR RECORDS.

Please forward the completed Lender and School copy of this Application and Promissory Note and your completed application for financial aid to the financial aid office of your school.

If you have any questions about how to complete this Application and Promissory Note, call the Commission:
1-515-281-3501

ICSAC Form 15C SNAP APP (Rev. 2.91)

LENDER COPY

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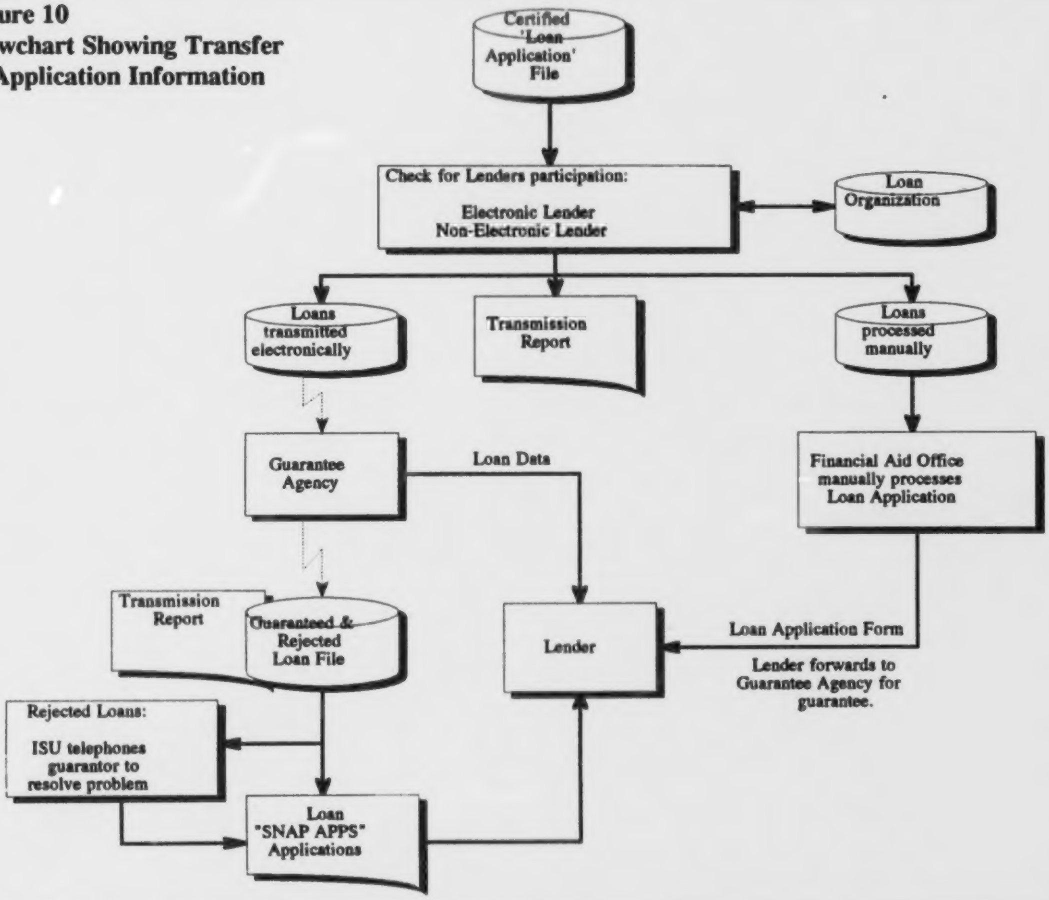
BEST COPY AVAILABLE

Data regarding all lenders who are participating in the student loan program is retained in a separate lender file. On a weekly basis, those applications that have been "certified" by an application processor are matched against the lender file. If the lender is participating electronically with the guaranteeing agency, the application data for that student is drawn into a separate file; the application record is marked as "transmitted," and the record is locked against further changes. During the next working day, this data is electronically transmitted to the guaranteeing agency via ISU's central processing system. The flowchart in Figure 10 shows the transfer of application information.

After the guaranteeing agency runs the data through its computer system in an overnight batch update, the data is returned to Iowa State University as either "guaranteed" or "rejected." A report is generated to the loan unit manager indicating the result of the transmission. Additional follow-up for "rejected" loans is performed with the guarantee agency via telephone, and the data can be resubmitted as often as necessary to get the loan guaranteed. Loan application forms are sent directly to the lending institution to be matched with the loan approval when it arrives from the guaranteeing agency. Because the application data is electronically transmitted, ISU is able to determine within 48 hours whether or not the loan is approved or denied. Also, because no data must be manually transcribed onto the Snap App form and further data entry has been eliminated, errors have been substantially minimized.

For applications where the lending institution does not participate electronically, the status is set to "manual," and a report is generated to the loan unit indicating that the applications for these students cannot be electronically transmitted. Loan unit staff uses this information to ensure the application is mailed to the correct location for further processing.

Figure 10
Flowchart Showing Transfer of Application Information


Certified 'Loan Application' File
Check for Lenders participation:
Electronic Lender
Non-Electronic Lender
Loan Organization
Loans transmitted electronically
Transmission Report
Loans processed manually
Guarantee Agency
Loan Data
Financial Aid Office manually processes Loan Application
Transmission Report
Guaranteed & Rejected Loan File
Lender
Loan Application Form
Lender forwards to Guarantee Agency for guarantee.
Rejected Loans:
ISU telephones guarantor to resolve problem
Loan "SNAP APPS" Applications

Funds Receipt

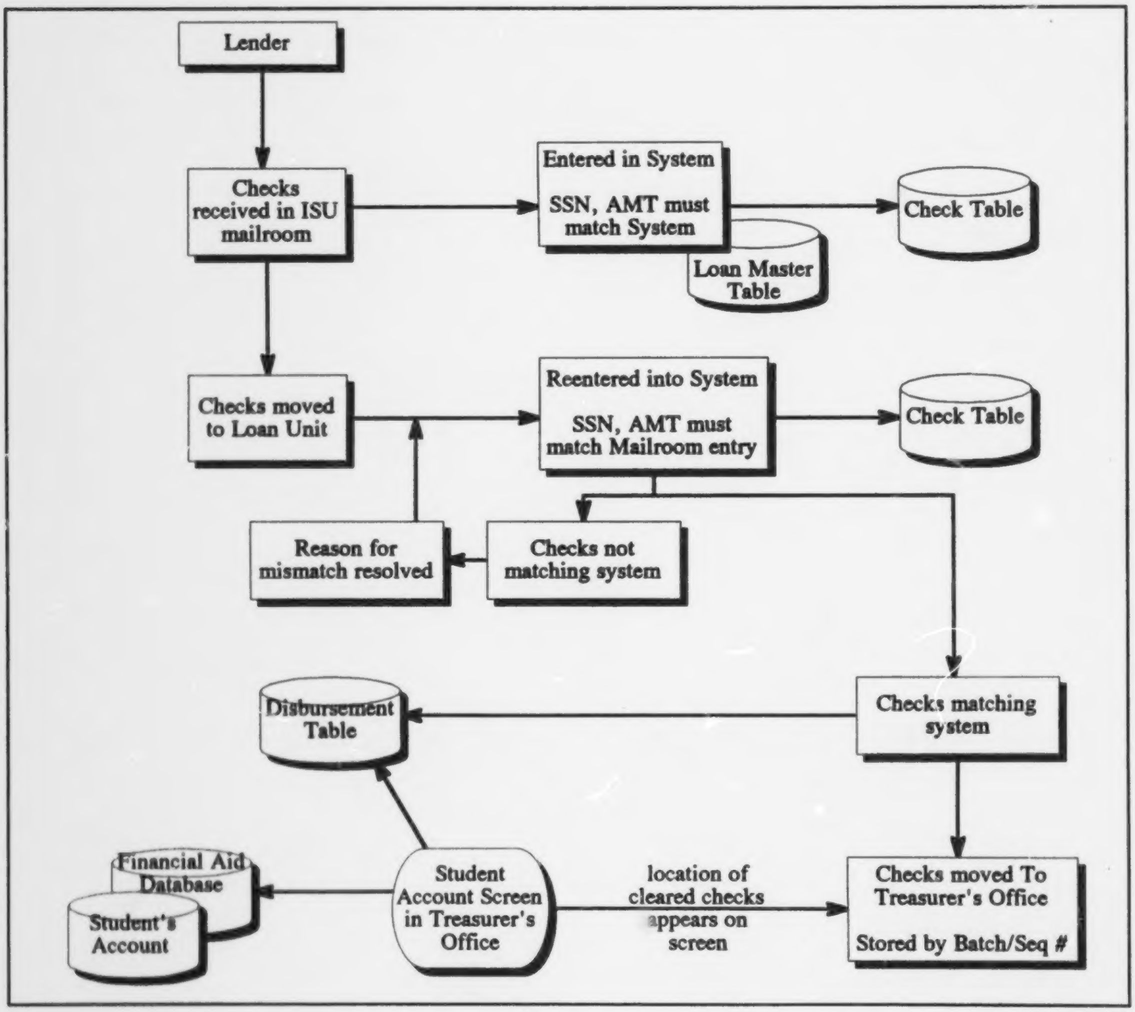
Receipt of funds can occur in one of two ways. The first, and more traditional method is for the lending institution to send a check to the school. The second method, a relatively new concept in student loans, is via electronic funds transfer (EFT).

Check Method

After the loan application has been approved by the guaranteeing agency, the approved amount is maintained on the computer system, and the actual amount of the fees withheld from the proceeds is also stored. When a check arrives in the Student Financial Aid Office mailroom, staff input the social security number, net amount, and the check number. Utilizing the new system, the mailroom staff processes the checks in the order they are received. Only those checks whose amount does not match the computer need to be sorted for special handling. The new procedures have reduced mailroom processing time at peak periods from several days to approximately three hours. A computer roster can be generated to satisfy auditing requirements as often as necessary.

The diagram in Figure 11 shows how funds are processed using the check method.

Figure 11
Flowchart of Check Processing


Lender
Checks received in ISU mailroom
Entered in System
SSN, AMT must match System
Check Table
Loan Master Table
Checks moved to Loan Unit
Reentered into System
SSN, AMT must match Mailroom entry
Check Table
Reason for mismatch resolved
Checks not matching system
Disbursement Table
Checks matching system
Financial Aid Database
Student's Account
Student Account Screen in Treasurer's Office
location of cleared checks appears on screen
Checks moved To Treasurer's Office
Stored by Batch/Seq #

Checks move from the mailroom to the loan unit where staff re-enter social security number, check number, and amount in a double-blind entry system. The system matches this entry against the one made in the mailroom and will not accept a check unless social security number, check number, and check amount agree. The social security number and check amount must match the guarantee information kept in the Loan Master table. If an error was made in entering the check number in the mailroom, the loan staff can correct the error. When the entries match, the check is loaded onto the student's account.

The terminal operator has the option, at the time the check is entered in the loan unit, to indicate whether the check receipt should be produced manually (typically done during non-peak periods), or if the system should produce the receipts automatically in an overnight batch mode. Giving the operator this flexibility allows the loan unit staff to provide instant check receipts when necessary (manual), reduces staff work during heavy check receipt periods (automatic option), and allows staff to monitor computer usage costs by eliminating unneeded computer runs. Receipts generated by the system review each file to ensure the student has maintained eligibility for the loan and will place a "HOLD" on the check until the student has met the required conditions. If the receipts are produced manually, loan unit staff must complete the edits manually and place the holds on the system.

Each check is assigned to a batch, with no batch exceeding 25 checks. The batch number is printed on the check receipt, maintained on the loan system screens, and accessed by the Treasurer's Office system for easy retrieval when the student arrives to endorse the check. All checks are now held within the Treasurer's Office rather than undisbursable checks being kept in a separate fireproof safe in the Financial Aid Office. If a student attempts to pick up a check but has not completed the necessary requirements to maintain eligibility, the Treasurer's Office system does not display the check as being available, and the student is referred to the Student Financial Aid Office to resolve the problem and have the "HOLD" removed. In this way, the Student Financial Aid Office still is able to maintain control over whether the student can receive the funds, a vitally important point when audited, but numerous trips between the Student Financial Aid Office and the Treasurer's Office have been eliminated.

Electronic Funds Transfer

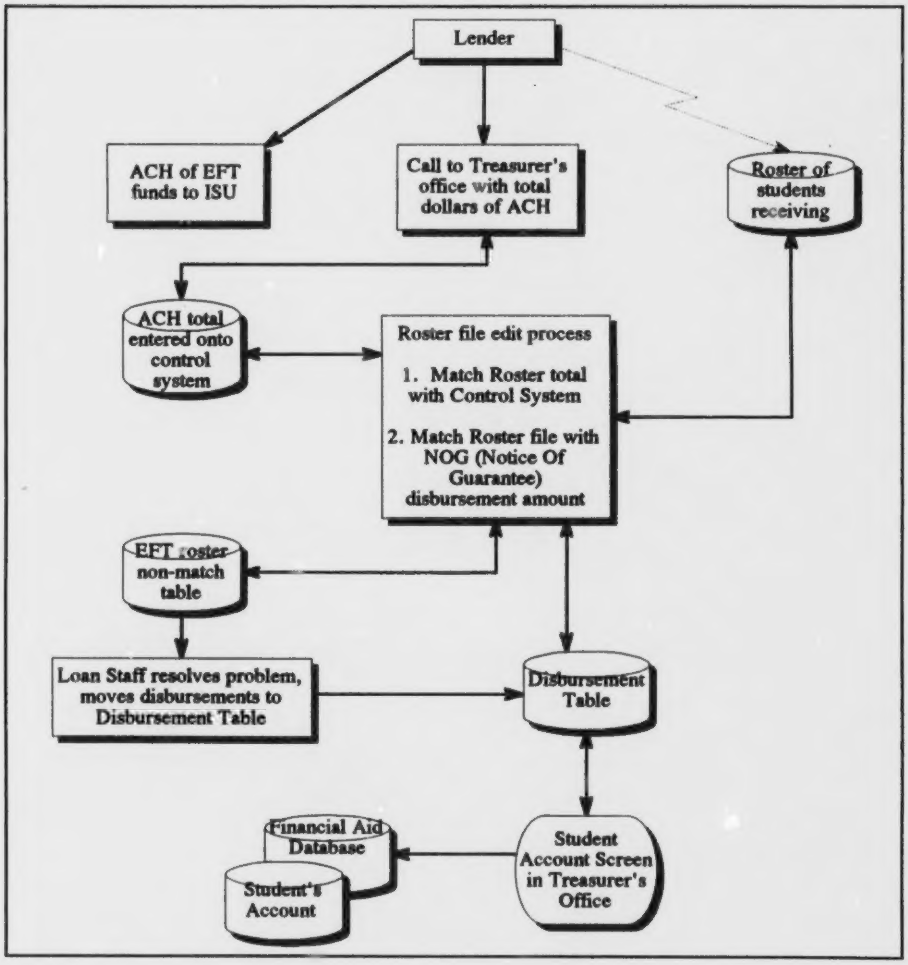
On a weekly basis, lenders who have agreed to participate in EFT with Iowa State University wire a bulk draft into ISU's Common Fund account through an Automatic Clearing House (ACH) transfer. On the same day the wire appears in the account, ISU receives a phone call and/or fax indicating the amount being wired, and this amount is entered into an EFT Control Screen. ISU then receives an electronic roster of all students and their dollar amounts contained in the wire transfer. In an overnight update, the funds from each lender are assigned to the correct student's account; the student's file is edited to ensure eligibility has been maintained, and an authorization letter is produced. Figure 12 shows a flowchart of how funds are processed electronically.

Federal regulation requires the student to sign the authorization letter in lieu of endorsement since there is no longer a physical check. An original copy, student copy, and mailing address label are delivered to the Student Financial Aid Office the next working day, and the authorization letters are sent to the student. The student needs only sign and return the authorization letter to the Student Financial Aid Office in order to have the "HOLD" on the funds released. If the student has failed to maintain eligibility for the loan, a separate form letter is enclosed with the authorization letter, and the student must resolve all problems before the funds are released to the account. If there are no problems, the funds are applied via a nightly batch process that is already utilized by the Treasurer's Office.

The EFT process has two very distinct advantages. First, there is far less handling for loan unit staff when the funds are received. Students are typically very anxious to receive funds quickly, and the EFT process allows loan unit staff to have large sums of money available to large numbers of students in a relatively short amount of time, compared to having to handle checks for each of those students. Additionally, the funds that are wired are held in an interest-bearing account until actually applied towards the student's bill. In this way, Iowa State University is earning some funds to offset the cost of computer development and support and fund a scholarship program.

A copy of the authorization form must be maintained in the Student Financial Aid Office and the original copy is forwarded to the lending institution as proof of receipt.

Figure 12
Flowchart of Electronic Funds Processing


Lender
ACH of EFT funds to ISU
Call to Treasurer's office with total dollars of ACH
Roster of students receiving
ACH total entered onto control system
Roster file edit process
1. Match Roster total with Control System
2. Match Roster file with NOG (Notice Of Guarantee) disbursement amount
EFT roster non-match table
Loan Staff resolves problem, moves disbursements to Disbursement Table
Disbursement Table
Financial Aid Database
Student's Account
Student Account Screen in Treasurer's Office

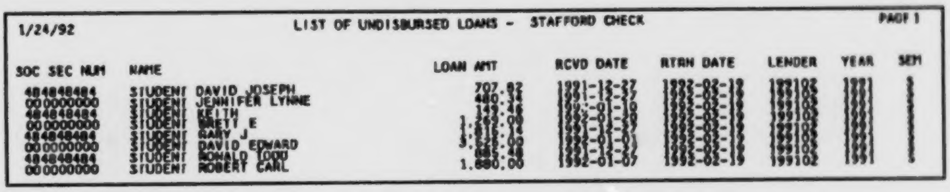
Reports

Federal requirements mandate that schools keep loan proceeds no more than 45 days. To assist in maintaining compliance with this regulation, the system generates the Undisbursed Loan Report, the Return Roster, and a Refund Report. Examples of these reports appear in the figures below.

Undisbursed Loan Report

This report is produced on a weekly basis and lists all funds that have not yet been picked up or applied to the student's account. Loan unit staff utilize this report to notify students via telephone that funds are available and must be picked up within 30 days.

Figure 13 Undisbursed Loan Report



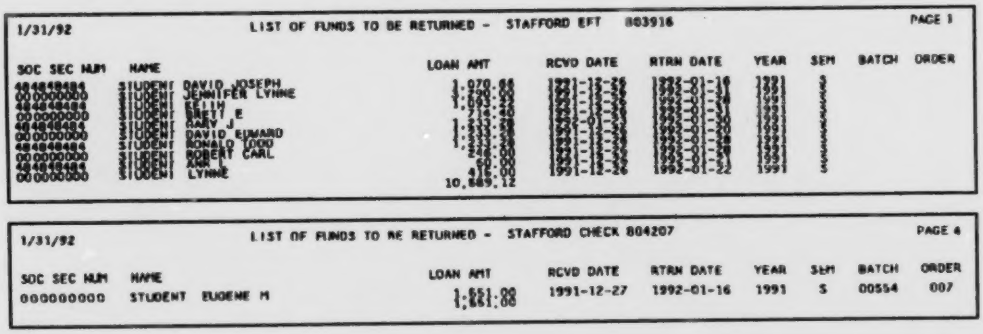
```
1/24/92                    LIST OF UNDISBURSED LOANS -  STAFFORD CHECK                        PAGE 1

SOC SEC NUM   NAME                             LOAN AMT    RCVD DATE    RTRN DATE   LENDER   YEAR   SEM
```

Return Roster

On the 15th and 30th of each month, a report is generated indicating funds that are 30-45 days old. Loan unit staff reviews this report, returns any checks that have not been picked up, and wires funds back to the lender for those participating in EFT. A separate roster indicating the reason for the return and the borrower's account number is faxed to the EFT lenders.

Figure 14 Examples of Return Rosters



```
1/31/92                    LIST OF FUNDS TO BE RETURNED -  STAFFORD EFT   803916                          PAGE 1

SOC SEC NUM   NAME                             LOAN AMT    RCVD DATE    RTRN DATE    YEAR   SEM   BATCH   ORDER
                                              10,689.12

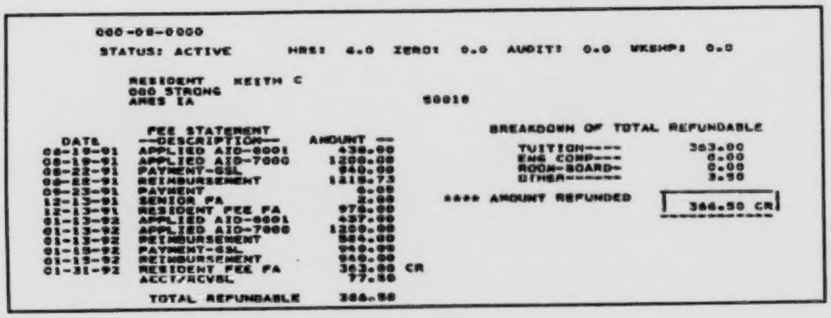
1/31/92                    LIST OF FUNDS TO BE RETURNED -  STAFFORD CHECK 804207                          PAGE 4

SOC SEC NUM   NAME                             LOAN AMT    RCVD DATE    RTRN DATE    YEAR   SEM   BATCH   ORDER
000000000     STUDENT  EUGENE M                1,851.00    1991-12-27   1992-01-16   1991    S    00554    007
                                               1,851.00
```

Refund Report

If a student's lender is participating in EFT and that student signed the authorization form to have funds released to his/her account and has a credit balance, the student's name will appear on a refund report that is produced weekly. If there are no additional charges against the student's account, a check is prepared and sent to the student since Iowa State University does not carry credit balances on student accounts.

Figure 15 Example of a weekly refund report



```
      000-00-0000
       STATUS: ACTIVE       HRS:  4.0  ZERO:  0.0  AUDIT:  0.0  WKSHP:  0.0

         RESIDENT   KEITH C
         000 STRONG
         AMES IA                             50010

            FEE STATEMENT                                      BREAKDOWN OF TOTAL REFUNDABLE
  DATE    --DESCRIPTION--      AMOUNT --
08-19-91  APPLIED AID-6001      438.00                            TUITION----        363.00
08-19-91  APPLIED AID-7000     1200.00                            ENG COMP---          0.00
08-22-91  PAYMENT-GSL           940.00                            ROOM-BOARD-          0.00
08-22-91  REIMBURSEMENT        1215.73                            OTHER------          3.50
09-23-91  PAYMENT                 6.00
12-13-91  SENIOR FA               2.00                  **** AMOUNT REFUNDED     |   366.50 CR|
12-13-91  RESIDENT FEE FA       976.00                                            ------------
01-13-92  APPLIED AID-6001      437.00
01-13-92  APPLIED AID-7000     1200.00
01-13-92  REIMBURSEMENT         584.00
01-15-92  PAYMENT-GSL           940.00
01-15-92  REIMBURSEMENT         940.00
01-31-92  RESIDENT FEE FA       363.00 CR
          ACCT/RCVBL             77.50

           TOTAL REFUNDABLE     366.50
```

Challenges In Implementing A New System

Although the Interactive Guaranteed Student Loan System has many advantages in respect to reduced turnaround time, reduced staff time, increased audit control, and ability to earn interest, there were many challenges in implementing the system. The primary challenge lay in converting to an entirely new way of working on student loans. With the new system, Iowa State University converted its application processing, application transfer, and funds receipt into an entirely new system. The conversion to application processing was available in April 1991. The first transmission of data was completed in July. The first funds were applied to the student's account in early July, after the first disbursement of the loan had been loaded under the previous system.

However, the challenges of the conversion have been largely outweighed by the advantages. The system is flexible, allowing the loan unit to react to changing federal regulations with relative ease. The system is interactive with other offices, allowing the business office more information regarding funds than ever before. Staffing has been reduced over previous years without any significant impact on service. And, finally, the rate of error has been substantially diminished.

Future Initiatives

Iowa State University continues to analyze ways to enhance the use of the interactive loan system. Plans are currently underway to expand the system to handle alternate loan programs in addition to the standard guaranteed loan programs. Further restrictions in the guaranteed loan program have brought about a series of alternate loans for middle-income families, which can easily be tracked via the loan system.

The system will also be easily adapted to a touchtone financial aid program currently under development, which will allow students to receive financial aid information about routine questions via telephone. Since the student loan program is the largest financial aid program administered by the Student Financial Aid Office, implementation of a touchtone system will greatly reduce staff time needed to answer repetitive questions and will allow students greater flexibility in getting answers to questions regarding financial aid.

Finally, plans call for the loan history information to be used when making financial aid awards. The current financial aid packaging parameters award a pre-determined amount without utilizing all available loan history information concerning eligibility. With the enhanced information available through the loan history summary, the Student Financial Aid Office will be able to generate an award letter containing recommendations for a loan that is accurate, given the student's grade level and previous borrowing activity.

Conclusion

While enhancements and refinements continue to be evaluated for the Interactive Guaranteed Student Loan System, the programs currently in place have met the overall goals of the Student Financial Aid Office. Student services have been enhanced, and staff has been reduced from 25 students and 3 full-time employees totalling 12 FTEs to 18 students and 2 full time employees, for a total of 7.5 FTEs. Additionally, staff workload has been reduced; errors have been virtually eliminated; the system is sensitive to costs, and staff can make some decisions regarding use of on-line versus manual modes to conserve costs. Finally, funds can be easily monitored to maintain compliance with ever-changing federal regulations.

Appendix: Overview of the Previous System

The computer support offered prior to the implementation of the interactive loan system consisted of a master system that contained all need analysis and financial aid packaging information, a document tracking system, and a loan application screen, which was an application information screen to support information only for the Stafford Student Loan program. Thus, the person processing the loan was responsible for manually loading information in three places on the computer system. Other loan types were not supported, nor was any information shared electronically with agencies outside Iowa State University.

Application Processing

Processing of student loan applications prior to the development of the Interactive Guaranteed Student Loan System required an average of 15 minutes per application. Each semester, a group of 25 student employees was put through an intensive training period to explain loan processing regulations. These individuals plus 3 full-time employees (total of 12 FTEs) were then responsible for processing the 16,000 loan application forms that arrived in the Student Financial Aid Office. Because of the complexity of the processing regulations and the uniqueness of each loan applicant's financial situation, the potential for error was great.

To combat this problem, the Student Financial Aid Office began offering On-The-Spot loan processing beginning in 1987. This service allowed a student loan borrower to be present at the time his/her loan was being processed and answer any critical questions the loan processing staff might have to ensure the loan was done properly. Although this service proved to increase accuracy, it also added to the time needed to process student loans. Additionally, information from the manual calculations was handwritten on the loan application form, often resulting in errors from numerical transposition.

Application Information Transfer

Prior to the development of the interactive system, processed loan application forms were divided into two piles. One stack was sent to the Iowa guarantee agency where the information from the application was key-entered onto its computer system for the approval process to be completed. The applications from the remaining stack were individually mailed to the lending institutions where additional input was entered on the application form prior to mailing to the Iowa guarantee agency. Typical turnaround time in the first scenario was three weeks and in the second scenario, four to six weeks. Although some lending institutions sent approval information before releasing funds, the Student Financial Aid Office usually had no indication prior to receiving a check that funds had been approved or for what dollar amount.

Funds Receipt

When funds arrived in the Student Financial Aid Office before the advent of the interactive system, only checks were received. Each check was manually logged in to indicate its receipt for future audits, and then the Student Financial Aid staff manually loaded the receipt of each check onto the document tracking system. Staff also were responsible for conducting all edits to ensure the student had maintained eligibility and placing a "HOLD" on funds until eligibility was re-established in the case of those students who failed the edit review. Staff then manually loaded student name, address, and social security number, lender name and address, check amount, and intended term dates into a microcomputer word processing system to print check receipts and letters. The check receipts were used to package the checks for delivery in the Treasurer's Office. The letters were sent to the students telling them that their funds had arrived.

To maintain control over the release of checks with a "HOLD," the Student Financial Aid Office did not deliver those checks to the Treasurer's Office. Rather, they were housed in a fireproof safe within the Student Financial Aid Office, and whenever a "HOLD" was released, staff would physically carry the check down two flights of stairs to the Treasurer's Office for release. During a typical registration period, this often meant 50-60 trips per day. The checks in the Treasurer's Office were maintained in social security number order, which meant that each new batch of checks had to be sorted and interfiled.

37th Annual College and University
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T3-3

Imaging at the University of Virginia: How We Broke Ground

Shirley Payne
Deborah Mills
University of Virginia

IMAGING AT THE UNIVERSITY OF VIRGINIA: HOW WE BROKE GROUND

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Introduction

Like many emerging technologies, imaging labors under the burden of conflicting definitions, unrealistic expectations, misunderstood benefits and pitfalls, and, consequently, misapplication. While we do not claim to have completely overcome these issues, we do feel we have had some success in guiding the University of Virginia towards the successful, cost-effective use of imaging. The purpose of our presentation is to share with you our thoughts on the significance of imaging to higher education, explain our methodology for initiating the use of imaging for selected functions at our institution, discuss our pilot project, and talk about our future plans for this technology. Administrative and library functions are the focal point of this presentation. Other information technology professionals at the University of Virginia are pursuing the use of imaging for medical-related applications in its hospital and for instruction and research. We will touch on these efforts by our colleagues only briefly.

Imaging Defined

Since we have found there is significant confusion about the definition of imaging, let us start by clarifying what we consider to be included in this technology. The Council on Information Management for the State of Virginia has defined imaging to be:

"the capability to capture, store, retrieve, display, process, manipulate and distribute a *digital representation* of a document, person or thing." [Imaging, Virginia Council on Information Management, March 1991]

This technology is separate and distinct from micrographics which is concerned with the retention on film of photographic, not digital, representation. Microfilm and microfiche are examples of micrographics technology. Images are stored digitally as a matrix of individual dots represented as "0" and "1" bit settings, which when viewed appear to represent the original document, picture, etc. The imaged data in and of itself has no real significance, as other types of digitized data do, but must be interpreted by a human to have meaning. In the scientific world the definition of imaging technology is very broad, including for example such futuristic concepts as virtual reality. In the business environment, however, imaging has a narrower scope which basically encompasses the automated management of textual materials, photographs, charts, and diagrams.

Until recently the technical limitations and high cost of imaging restricted the use of this technology. But since the mid 1980's, strides have been made in moving the technology out of the research labs and into the business world. We are now beginning to see the implementation of major imaging applications in certain industries, and leading firms are reassessing their business processes to take advantage of the technology. It is time for higher education, which is so concerned today with reducing costs and improving competitiveness, to give this technology serious consideration. A cursory look at the potential applications for imaging in higher education yields the following:

Admissions - The retention and retrieval of formal applications from prospective students, letters of recommendation, and other correspondence, as well as selection committee comments and decisions.

Financial Aid - The retention and retrieval of financial aid applications, correspondence, and financial aid award information.

Student Records - The storage of correspondence, faculty advisor comments, and other documents accumulated for registered students.

Library - The electronic storage and viewing of multimedia reference materials.

Human Resource Management - The retention and retrieval of current applicant information.

Purchasing - The processing of purchase requests from the point of departmental requisition through the issuance of a purchase order.

The UVa Dilemma

As information technology professionals responsible for the effective use of computing in administrative and library functions, we were excited about the potential imaging technology held in these areas. In the spring of 1991 we began to develop an organized approach to addressing this technology. In assessing the readiness of our client environment for imaging, we were concerned about several possible obstacles to progress:

(1) Like most other institutions of higher education, UVa had been undergoing painful budget cutbacks. At a time when many staff and faculty positions were going unfilled, construction projects were being

placed on hold, and the future budget situation was unknown, the focus, understandably, was simply on trying to keep existing operations going. Innovations of any kind were being viewed by some as luxuries we could ill-afford.

(2) There was very little knowledge of imaging among our clients and, for that matter, there were few with in-depth knowledge within the computing organization. Those who had read articles about the successful use of imaging in other industries were interested in the technology's potential, but did not have enough information to make good judgements regarding appropriate uses and cost-benefits. The prevalent view was that imaging was best used to archive huge volumes of static data, at a very high price. Given this assumption (which, as we shall see, is incorrect) and the very bleak budget outlook, there was little impetus for clients to incorporate imaging into their strategic plans.

(3) Despite these problems, there were a few isolated pockets of image application development beginning to surface. The UVa hospital in particular was pursuing strategies for medical-related applications, such as storing and retrieving medical records of patients, and certain faculty members were beginning to push for a concerted effort to apply imaging technology to research and classroom instruction. The Human Resources Department was also experimenting with an imaging product on its departmental minicomputer. It seemed unless a common direction for imaging was soon crafted, there was the very real possibility that the University would have a hodge-podge of imaging implementations which could not be interconnected and would be difficult and expensive to maintain. This would have been a significant problem for business- and student-related applications where there is a strong need to collect and disseminate information among a wide-range of administrative and academic offices.

The UVa Solution

It was obvious that the first order of business was to develop a common knowledge base among our clients, those responsible for delivery of administrative and library services to the University community. But, exactly how would this be accomplished, who specifically would be targeted, and, once the basics of imaging were understood, how would we proceed? The methodology we landed upon to generate interest in imaging and to build and maintain momentum in applying the technology had the following steps:

(1) Conduct a presentation on imaging for those involved in defining the University's strategic plan.

(2) Issue questionnaires to attendees to help us assess interest levels.

(3) Follow up with interested clients to carefully analyze potential applications in their offices.

(4) Select from all candidate applications a single application for pilot testing.

(5) Obtain seed money for the pilot.

(6) Upon completion of the pilot, widely publicize results within the University and recommend future strategies for imaging based on these results.

Because we did not consider ourselves experts in the subject, we enlisted help from IBM in putting together the presentation. We felt it was especially important to present the technology within the context of higher education issues, and we were fortunate to have the participation of a member of IBM's Academic Computing Information Systems organization which works with institutions like UVa on issues of successful technology transfer. Since our primary objective in giving the presentation was to capture the interest of and open up discussions with key administrators and faculty about the business and academic opportunities for imaging, we invited executive management, department heads, and interested faculty. The meeting was kept to two hours and was scheduled between the spring and summer academic sessions to encourage attendance. The presentation was non-technical, focusing instead on the definition of imaging, its potential benefits, and appropriate criteria for selecting imaging applications. A video of imaging users giving testimonials to the significant benefits associated with the technology was shown and handouts providing more detailed information were distributed.

Responses to the questionnaires received after the presentation were very positive. Follow-up studies we conducted involved graduate and undergraduate admissions, financial aid, purchasing, and library services. Separate meetings with each department were held to discuss potential applications, compare them against our criteria for analyzing appropriate uses of imaging, and conduct a workflow study for each candidate application. The selection criteria we used for evaluating proposed applications were taken from materials provided by IBM and Virginia's Council on Information Management. We consider applications with the following characteristics to be good imaging applications:

Document Intensity - There are a large volume of documents and multiple types of documents.

Document Filing - Documents can be grouped into logical folders. Documents are often added to these folders.

Document Retrieval - There is a need to reorder folders and select documents from folders based upon certain criteria.

Document Adjustment - There is a need for adjustment of contrast of documents or the need to screen the display of selected portions of the documents when viewed.

Process Workflow - The process for handling these documents has multiple steps, involves multiple people, and is labor intensive. The routing process is predictable.

Process Approval - There are multiple approval levels in the process.

Process Elapsed Time - Shortening the elapsed time of the process will result in cost savings, fewer errors, and/or improved service levels.

Physical Storage Space - Reduction in physical space for document storage will result in cost savings or cost avoidance.

From the applications evaluated we selected one for the pilot project, a subset of the graduate admissions process. The challenging task of gaining support and funding then began. Fortunately for us, our efforts coincided with IBM's attempt to find beta test sites for their OS/2-based version of IMAGEPLUS, one of the leading imaging products currently on the market. After extensive consideration, IBM and UVa entered into a jointly-funded, partnership arrangement to conduct the graduate admissions pilot project on the OS/2 Imageplus platform. Because of the LAN-based solution, our initial investment was small and, as a beta test site for IBM, we received extra attention from the vendor on implementation issues.

Scope of the Pilot Project

The Graduate School of Arts and Sciences Admissions Office (GSASAO) processes approximately 5000 applications per year. As our pilot project we chose to process approximately 1000 applications, which happens to coincide with the quantity of applications received for the English Department. The pilot is contained totally in the GSASAO and does not include the individual departments. Currently, the department's processes remain the same. Our pilot project was chosen for several reasons. The application was small and very self contained. If the project was unsuccessful, the hardware was either usable by the office for other purposes or easy to sell, therefore, no throw-away hardware. Since, the need for processing improvements was great and the risk was low, the opportunity to increase our knowledge of imaging with "hands-on experience" was an easy decision to make.

Current Workflow

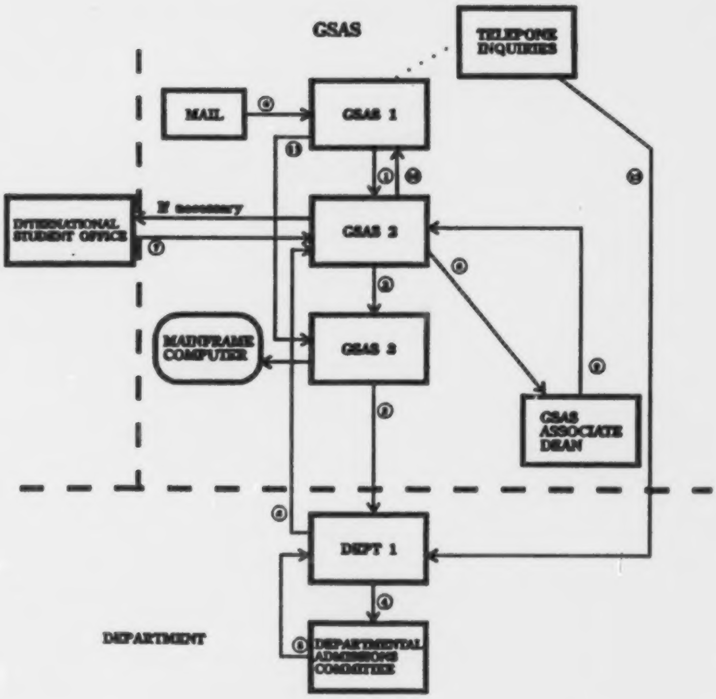
The current workflow is a good candidate for imaging because of the large number of documents to be processed (i.e., transcripts, applications, letters of recommendation, test scores, office correspondence to the applicant, etc.), the documents were referenced frequently during the admissions process and the need to allow concurrent access to the documents. The current workflow is processed in the following steps:

GSASAO Employee 1	Opens the mail
GSASAO Employee 2	Codes the application Processes the check
GSASAO Employee 3	Enters data in the online student system Searches for miscellaneous documents "Makes" departmental copy of ALL documents and forwards to department Creates a folder Files
Departmental Employee 1	Receives the documents Creates a folder Files
Periodically --	Reviews folder for completeness Forwards folders to the departmental admissions review committee
Departmental Admissions Review Committee	Reviews admissions folder Makes admissions decision notes on copy of application
Departmental Employee 1	Returns copy of application to GSASAO
GSASAO Employee 2	If foreign student, forward to office for International Students, else, to Associate Dean of GSASAO
International Student Office	Review for completeness of foreign student requirements and notes findings Returns to GSASAO

Associate Dean of GSASAO	Reviews application and notes decision
GSASAO Employee 2	Lists remaining requirements for admission Forwards to GSASAO Employee 1
GSASAO Employee 1	Prepares admit/deny letter Forwards admission decision to GSASAO Employee 3
GSASAO Employee 3	Keys admission decision into online student system

****

GSASAO Employee 1	Receives telephone calls concerning applications and forwards caller to department


GSAS
TELEPONE INQUIRIES
MAIL
GSAS 1
①
INTERNATIONAL STUDENT OFFICE
If necessary
GSAS 2
MAINFRAME COMPUTER
GSAS 3
GSAS ASSOCIATE DEAN
DEPT 1
④
DEPARTMENT
DEPARTMENTAL ADMISSIONS COMMITTEE

How We Began The Pilot

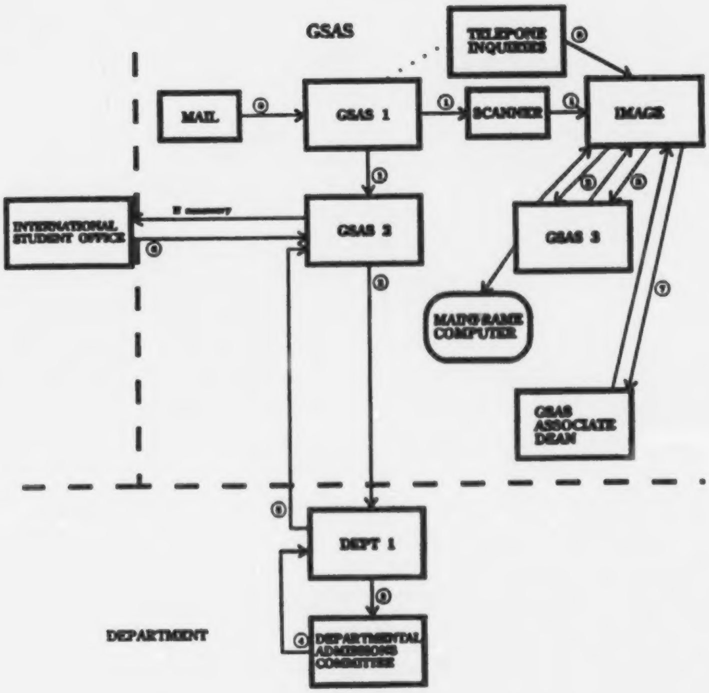
After our proposal was accepted, we attended an Early Support Testing (EST) class on Imageplus for OS/2 and our image programmer/analyst also attended a LAN/server class. After attending class, we felt the GSASAO was going to be overwhelmed by the equipment change alone, since they were currently using dumb terminals. We suggested they begin using PCs doing terminal emulation and to begin experimenting with a mouse and a window type application. For a novice user, a mouse and the layers of windows can be scary. The employees of GSASAO have done an excellent job of teaching themselves how to use the mouse and familiarizing themselves with pull down menus, handling various windows, etc. We, in the computer center, were simultaneously developing a tentative imaged workflow. It is as follows:

GSASAO Employee 1	Opens the mail
GSASAO Employee 2	Processes the check
GSASAO Employee 3	Searches for miscellaneous documents Scans the documents Enters data into the online student system from the imaged document Forwards application to the department
Departmental Employee 1	Receives the documents Creates a folder Files
Periodically --	Reviews folder for completeness Forwards folders to the departmental admissions review committee
Departmental Admissions Review Committee	Reviews admissions folder Makes admissions decision notes on copy of application
Departmental Employee 1	Returns copy of application to GSASAO
GSASAO Employee 2	If foreign student, forward to office for International Students, else, to Associate Dean of GSASAO
International Student Office	Review for completeness of foreign student requirements and notes findings

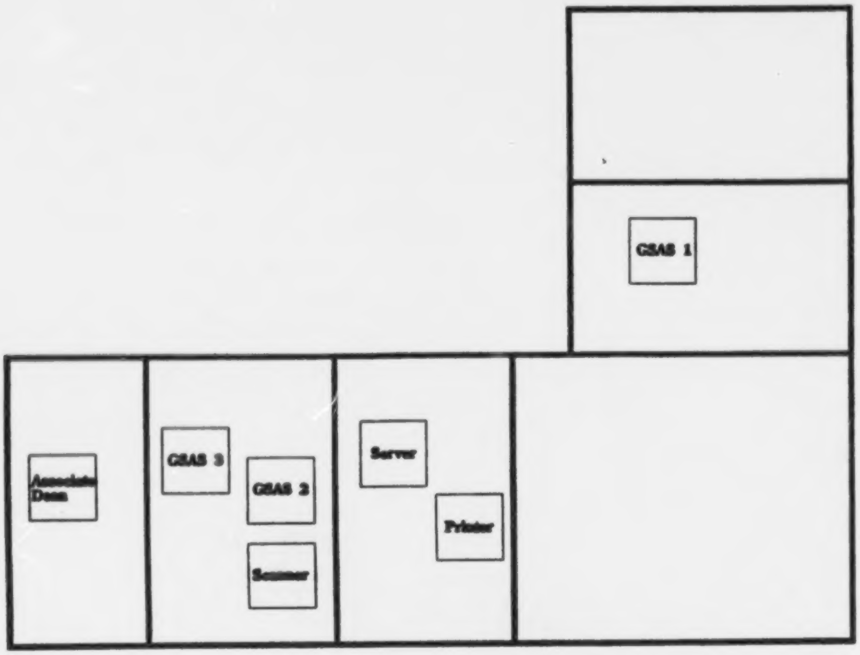
	Returns to GSASAO
Associate Dean of GSASAO	Reviews the imaged application and notes decision on the imaged folder and lists remaining requirements for admission
GSASAO Employee 3	Keys admission decision into online student system from imaged folder note and a computer generated letter of admission/denial is produced

****

GSASAO Employee 1	Receives telephone calls concerning applications and forwards to department, except in cases of call to the English Department when clerk retrieves image of document and responds to questions


GSAS
TELEPONE INQUIRIES
MAIL
GSAS 1
SCANNER
IMAGE
INTERNATIONAL STUDENT OFFICE
If necessary
GSAS 2
GSAS 3
MAINFRAME COMPUTER
GSAS ASSOCIATE DEAN
DEPT 1
DEPARTMENT
DEPARTMENTAL ADMISSIONS COMMITTEE

We initially installed the hardware and software at the administrative computing site; the user's physical area was very small. After the equipment and software were installed and tested we moved everything to GSASAO. Here is the layout of the installed equipment.



We had a known problem before we started: the GSASAO has a very small staff. One employee had recently taken early retirement, and the department was not allowed to replace her. This meant the existing staff had to perform both the old workflow without image and the new workflow with image. This could possibly become very confusing and frustrating for the staff.

This project is currently in the implementation phase. We plan to additionally cover the following topics at our presentation:

User training
User acceptance
System performance and functionality
What we learned

Further Development of Pilot Project

The future plans are to image all the applications for GSASAO next year. Departmental access will also be added where requested.

We anticipate that our next major image project will be for Undergraduate Admissions. They currently receive 21,000 applications for 3,045 entering class positions. The Undergraduate Admissions Office projects they will receive 30,000 applications in the very near future. Currently their process has three readers review each application. This process is cumbersome and with the prospect of even more applications the task becomes overwhelming. This is another good application for imaging. Listed below are some of the benefits to be derived from imaging this office:

- Reduction of paper work and of paper flow would increase staff productivity
- Reduction of space requirements
- Provide simultaneous access for multiple users
- Provide rapid access to files
- Provide integrated text, data and image on one workstation
- Provide the ability to accept facsimile transmissions of applications.

Long-Range Plans

As we implement our pilot project, we are conducting other parallel efforts to help ensure an effective, long-term strategy for imaging technology use. Our effort involves the coordination of all imaging initiatives at the University. Representatives from the medical, administrative, and academic computing functions at the University are meeting periodically to share plans and technical information about image-related activities. We are also in the process of evaluating imaging products from other leading vendors. Upon completion of our project in the first quarter of 1992, we will document the project effort and its results, define specific additional imaging applications, and recommend strategies for building an infrastructure and creating standards that would allow us to move forward with imaging technology. We will use our pilot application as a cornerstone for future efforts to educate our user community on the advantages and disadvantages of imaging. Through this continuing educational process, we are expecting creative ideas on the use of this exciting technology to begin surfacing in the strategic plans developed by our administrators and faculty. And, through our own aggressive efforts to educate ourselves on and test the potential of imaging technology, we expect to be ready to address these needs as they are defined.

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T3-4

Information Technology Issues in the 1990s: An Analysis from a CAUSE Postcard Survey

Michael Zastrocky
CAUSE
M. Lewis Temares
University of Miami

Information Technology Issues in the 1990s: An Analysis from a CAUSE Postcard Survey

M. Lewis Temares, Ph.D.
Vice President & CIO for Information Resources
University of Miami

Michael R. Zastrocky, Ed.D.
Vice President
CAUSE

Introduction

Issues facing higher education are bountiful. Finances, diversity, student financial aid, political correctness, and tuition are only a few. Within this framework of uncertainty, the senior computing person has to operate proactively and reactively to the changing needs of her/his constituency. With that in mind, many surveys of the key issues confronting the information technology leader are undertaken. The main purpose of these surveys is to provide direction and insight to the person immersed in daily critical problems as to what the bigger picture over the next few years will look like. Few, if any, surveys of this nature exist for the the higher education industry. The data and the information contained in this paper are designed to fill a void and serve as a comparison to other industry surveys.

The issues that were included in this CAUSE postcard survey were derived from the authors' experiences and from reviews of current literature dealing with IT issues facing industry and higher education. (A CAUSE postcard survey is designed to be short and fit on one side of a postcard.) The survey was also designed to allow participants to list and rank other issues which were deemed to be important IT issues for their campus in the 1990s. Data from the CAUSE Institution Database (ID) were downloaded and merged with the postcard data. This allowed the researchers to analyze the data based on various institutional characteristics, including size, control (public or private), and Carnegie classification. (For the purposes of this study, institutions have been grouped by the categories used in the classification of U.S. institutions of higher learning by the Carnegie Foundation for the Advancement of Teaching. Categories Comprehensive I and II were combined under the heading "Comp," Doctoral Granting I and II under "Doctoral," Liberal Arts I and II under "Liberal Arts," and Research I and II under "Research.")

Survey Instrument

One of the many CAUSE member services is the Postcard Survey Service. Members can conduct informal surveys of other CAUSE members to collect information through a survey postcard sent to all member campuses. Members return these pre-addressed postcards either to the member requesting the information or to the CAUSE national office. While this survey was instituted by Dr. M. Lewis Temares, Vice President for Information Resources and Chief Information Officer at the University of Miami, the survey was mailed back to the CAUSE national office and data entry was handled by Le Ann Coffey, CAUSE National Office Secretary. Data analysis was performed by Dr. Temares and Dr. Michael Zastrocky, CAUSE Vice President. This survey was mailed to 888 institutions of higher learning in the U.S. and to all CAUSE international member campuses. The response rate was 56.6% with 503 completed postcards received. The following questions were included on the postcard survey:

CAUSE Postcard Survey: IT Issues in the 1990s

Rank the following information technology issues in order of importance to you in the 1990s. (1 =greatest importance. Use the "other" line if an issue you consider important isn't listed.)

_____Reengineering

_____Networking

_____Staff Development

_____Aging Systems

_____Effectively coping with limited resources

_____Developing an IS strategic plan

_____Integrating information systems

_____Determining the value of IS

_____Software productivity and reliability

_____Integrating computing into the curriculum

_____Other: ______________________________

____

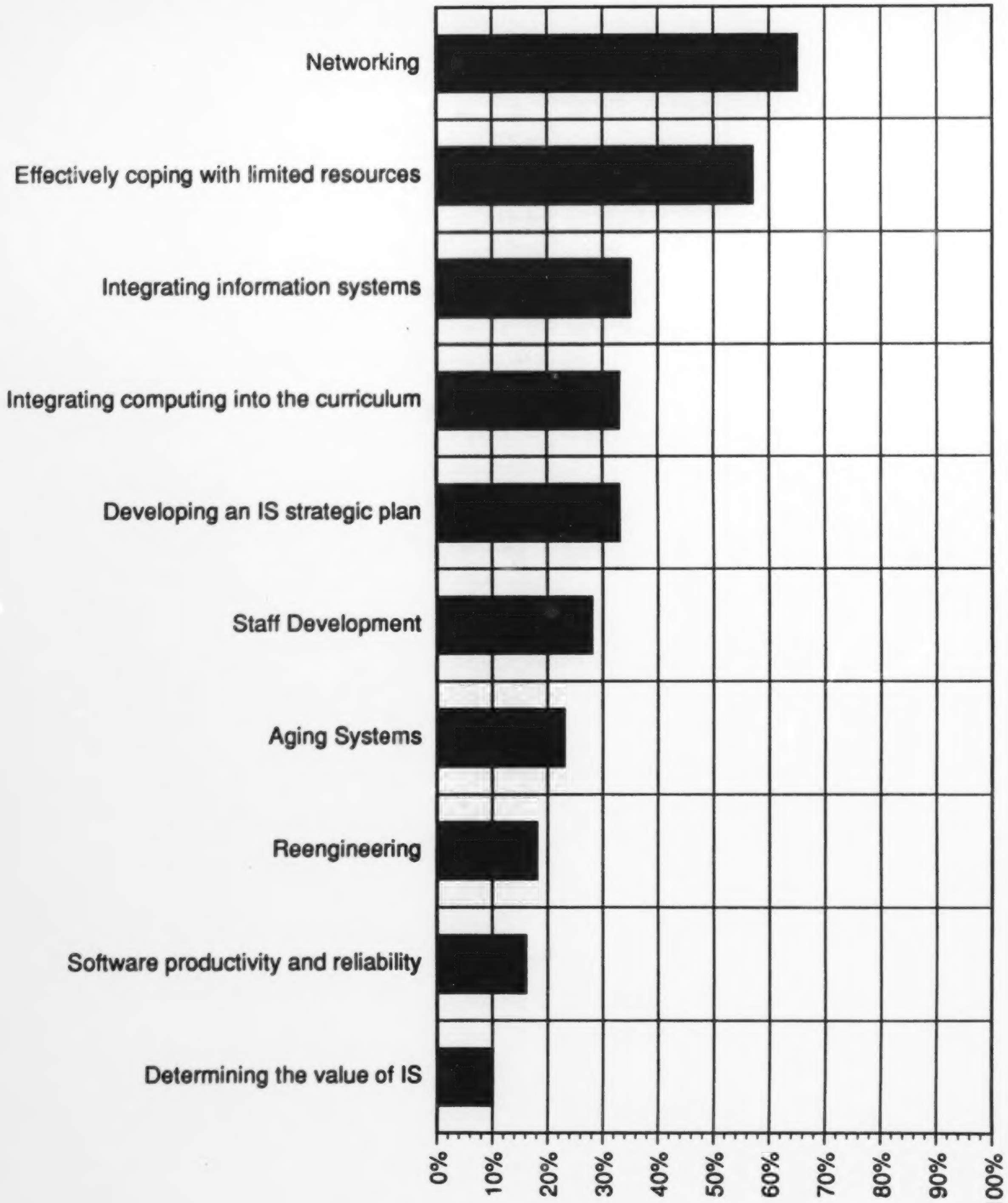
Institution name: __________________________

____

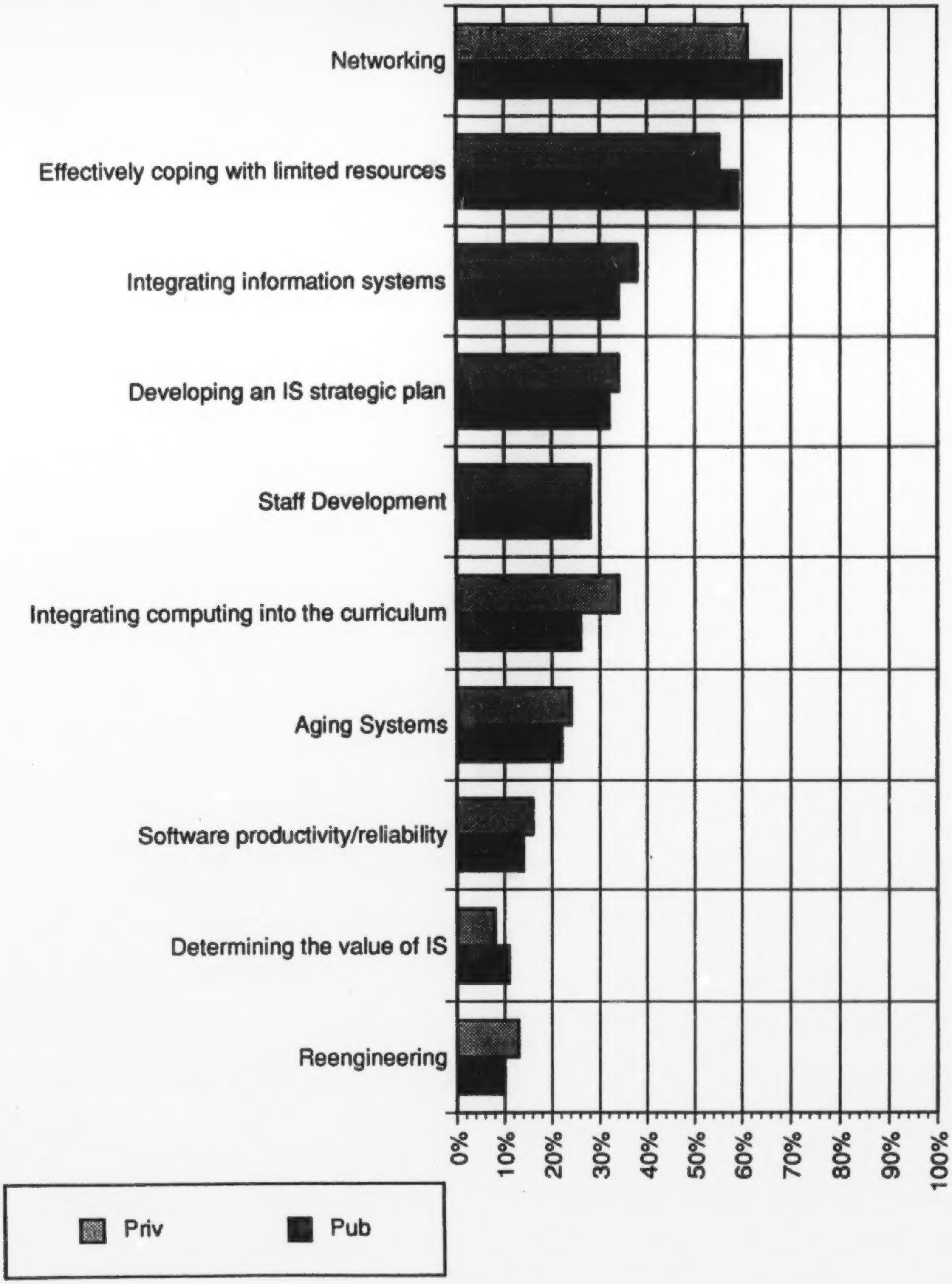
Summary of Results

Networking and effectively coping with limited resources are identified as the most critical issues facing higher education during the 1990s. What is interesting is that the ranking of these two issues was generally the same regardless of size, Carnegie classification, or control (public versus private). The other issues varied slightly in ranking based on the demographics. The researchers have decided to run another similar survey in the fall of 1992 and look for changes and shifts in responses. The first set of charts indicate the ranking of all responses in the top three category based on size, control, and Carnegie classification. The second set indicates the ranking of all responses in the bottom three based on the same characteristics. The last set of charts is the actual frequency distributions of all responses. Finally, an alphabetized list of all responses to the "other" category is included and provides another view of the important issues facing the people who manage information technology in higher education during the 1990s.

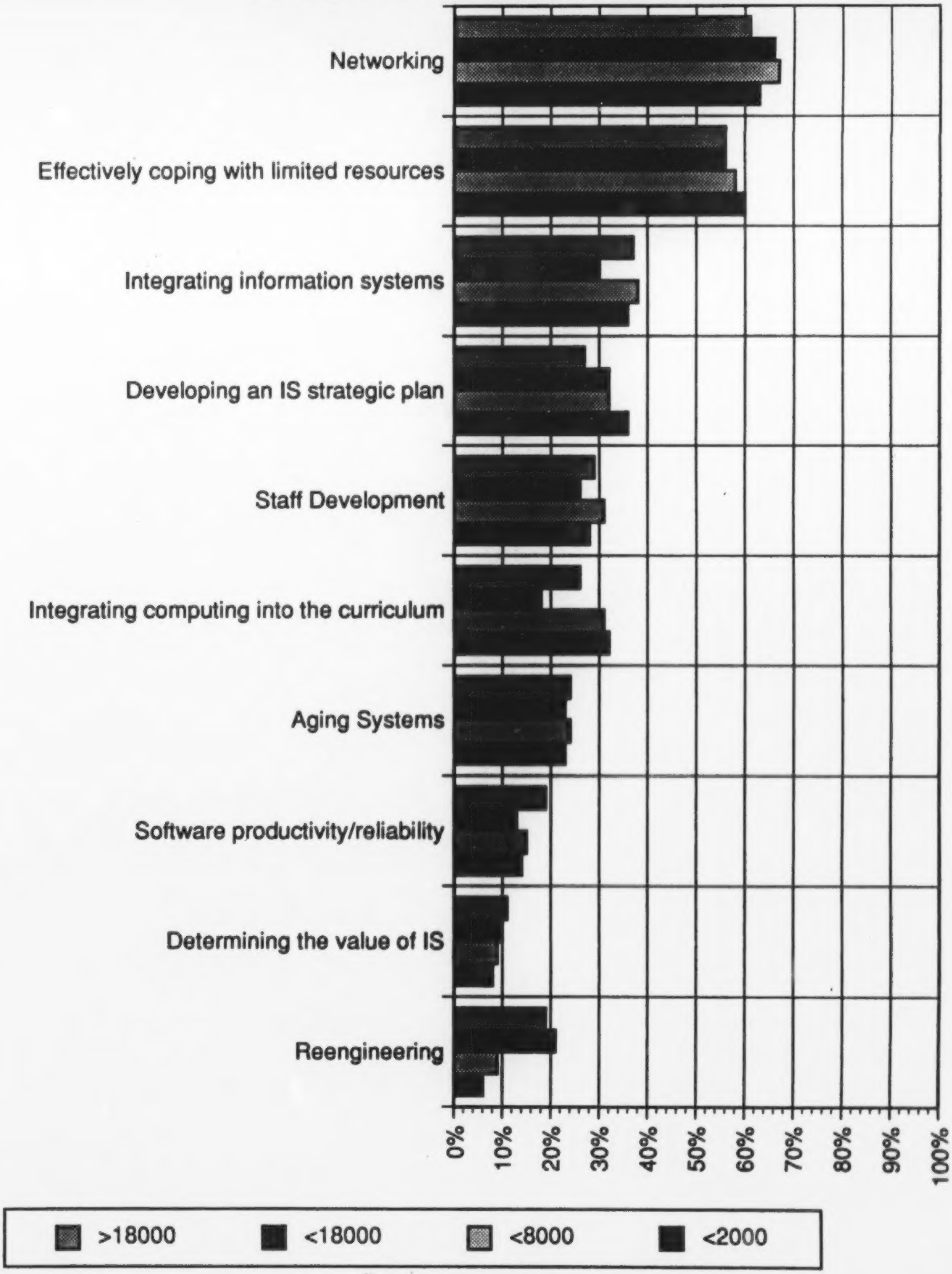
Percent of all institutions who ranked each issue ≤ 3 (Top Three)



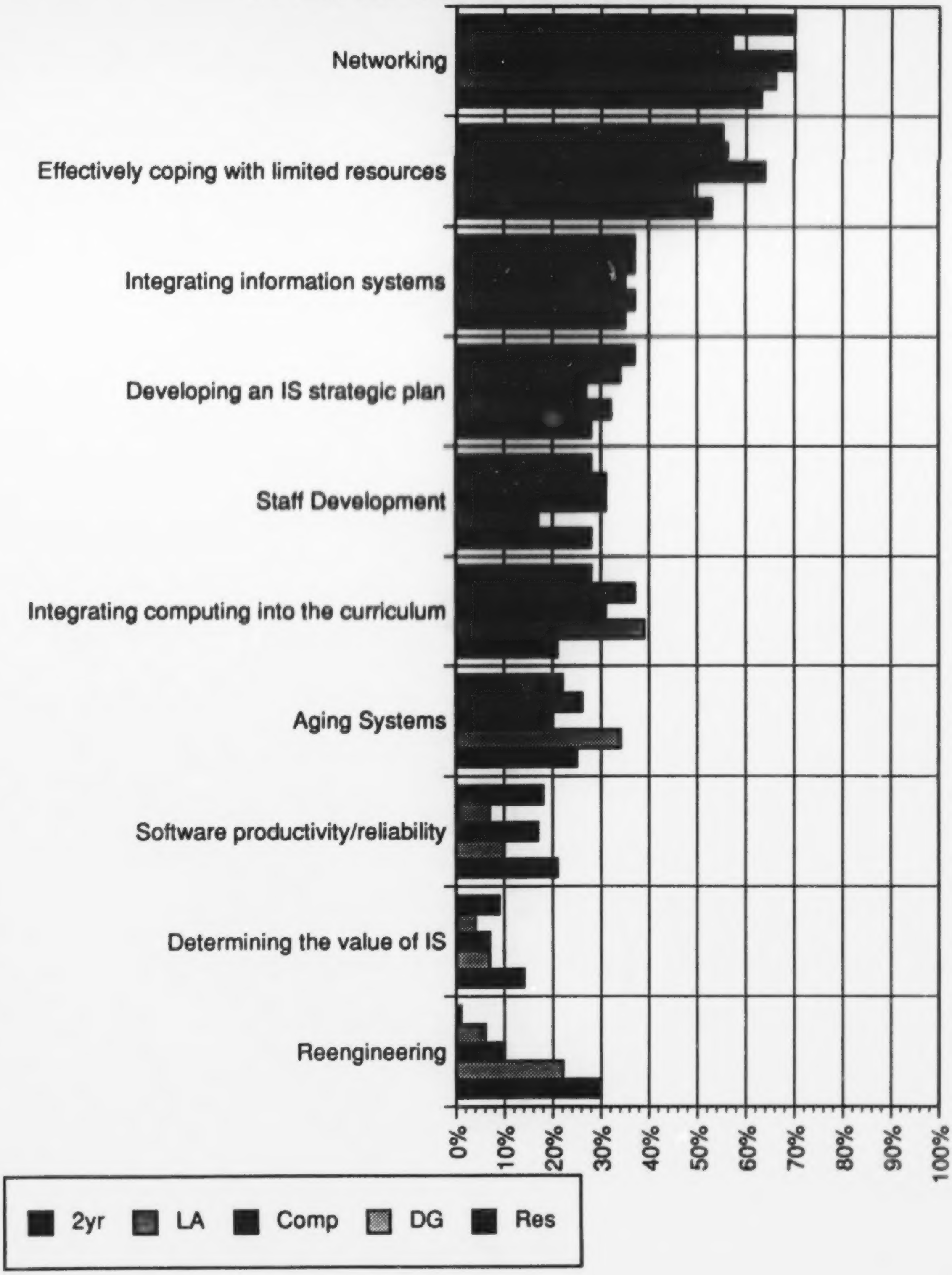
Percent of institutions who ranked all issues ≤ 3 (Top Three) by Control



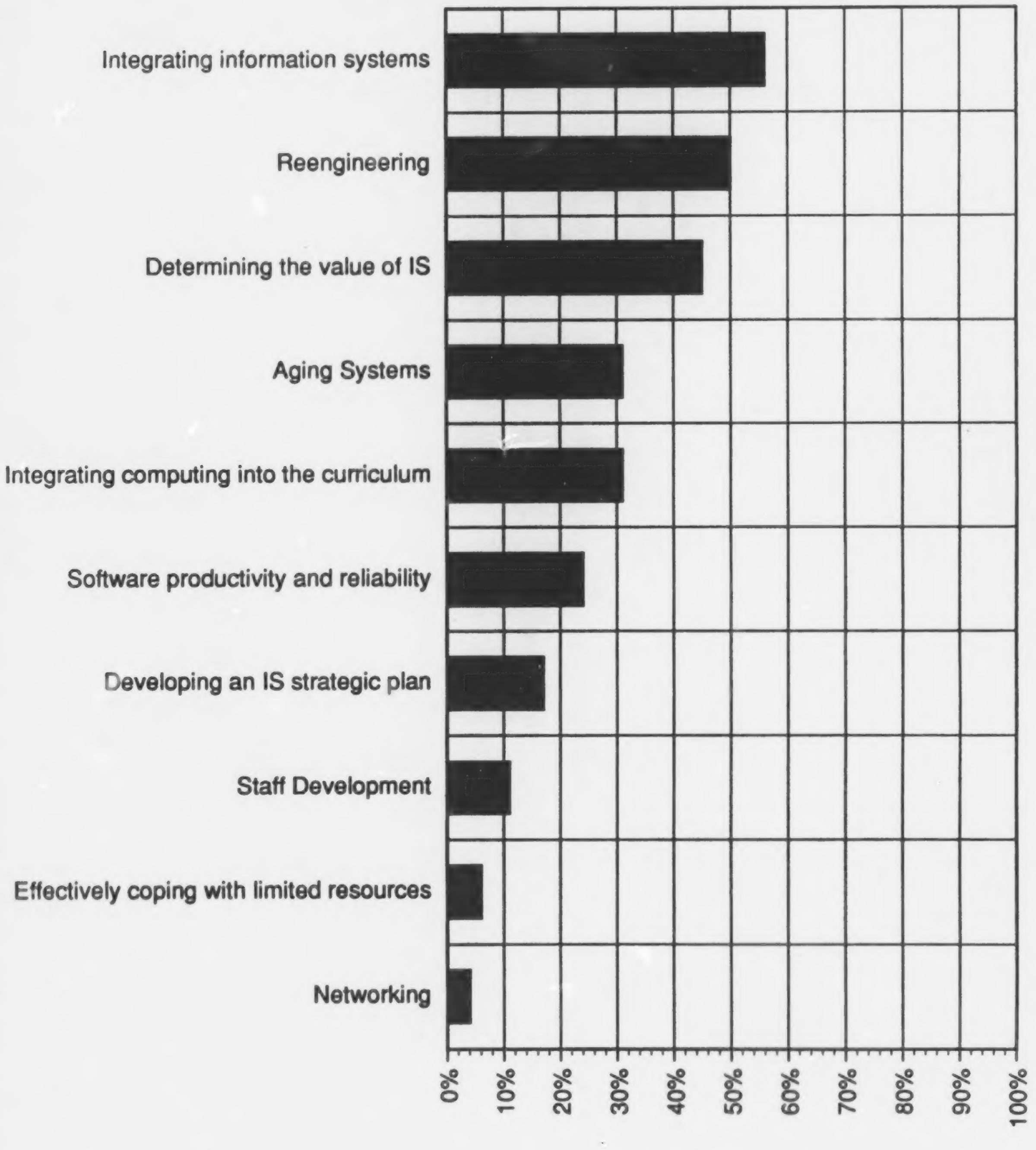
Percent of institutions who ranked all issues ≤ 3 (Top Three) by institutional size (FTE)



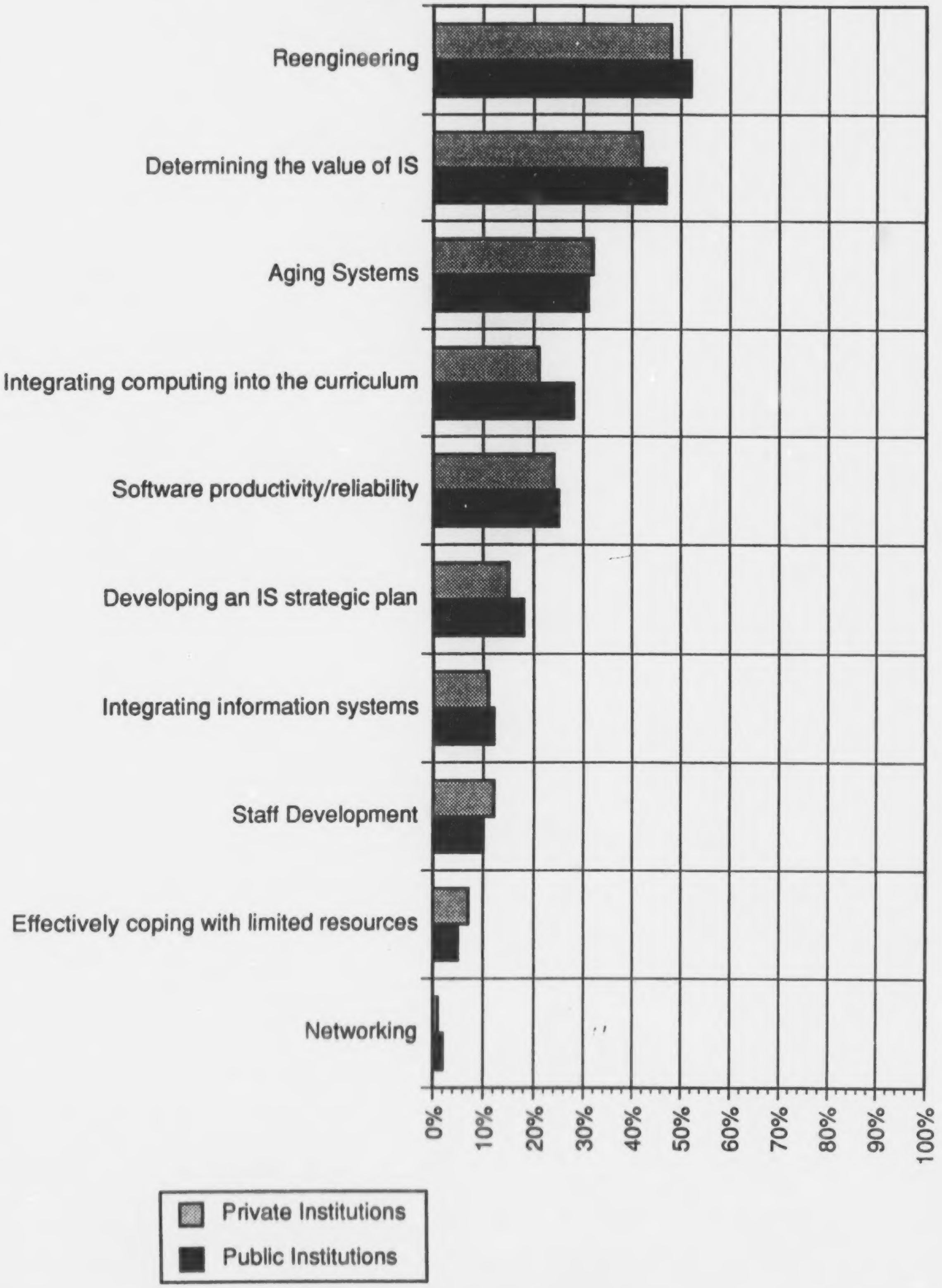
Percent of institutions who ranked all issues ≤ 3 (Top Three) by Carnegie Classification



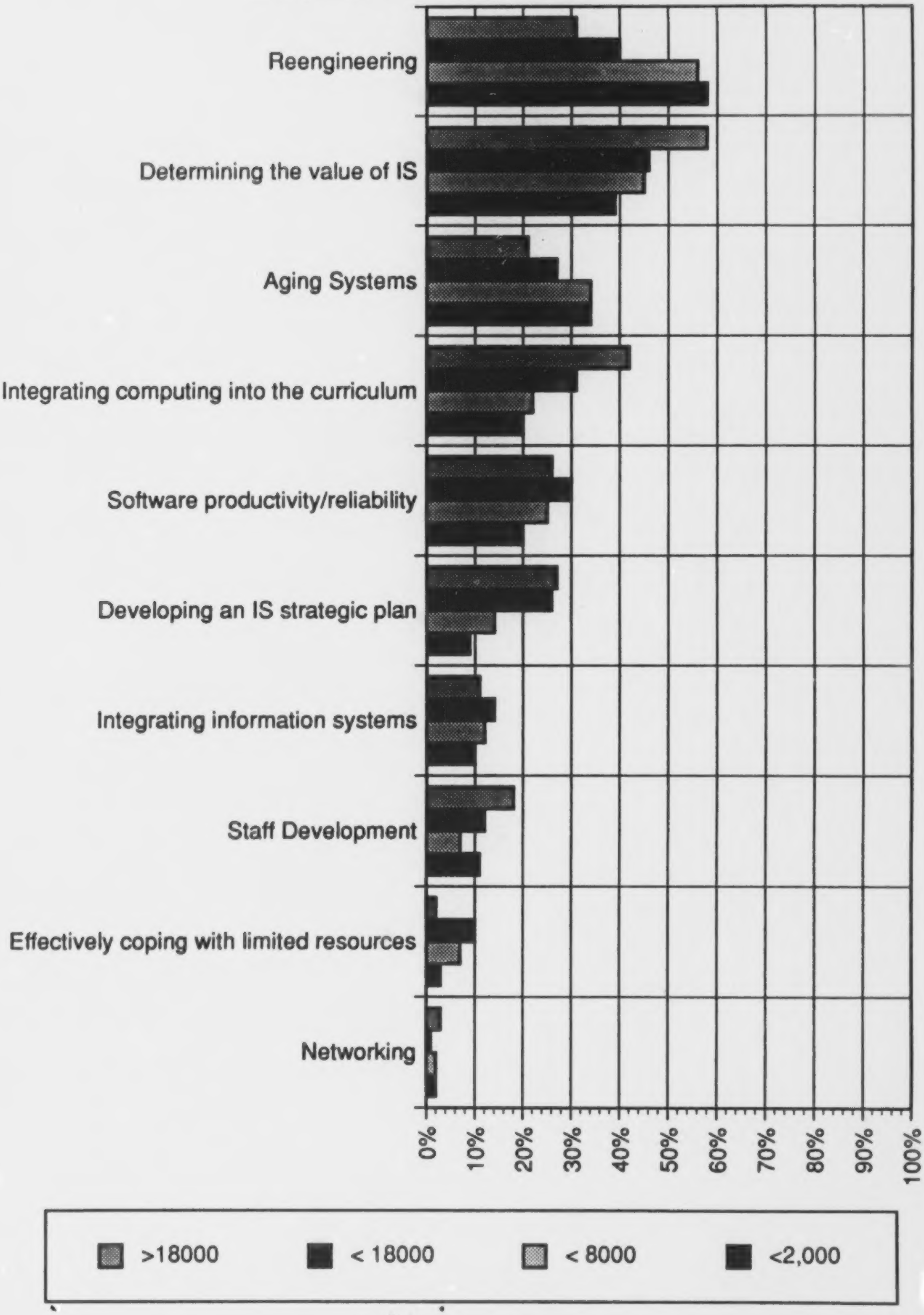
Percent of all institutions who ranked each issue ≥ 8 (Bottom Three)



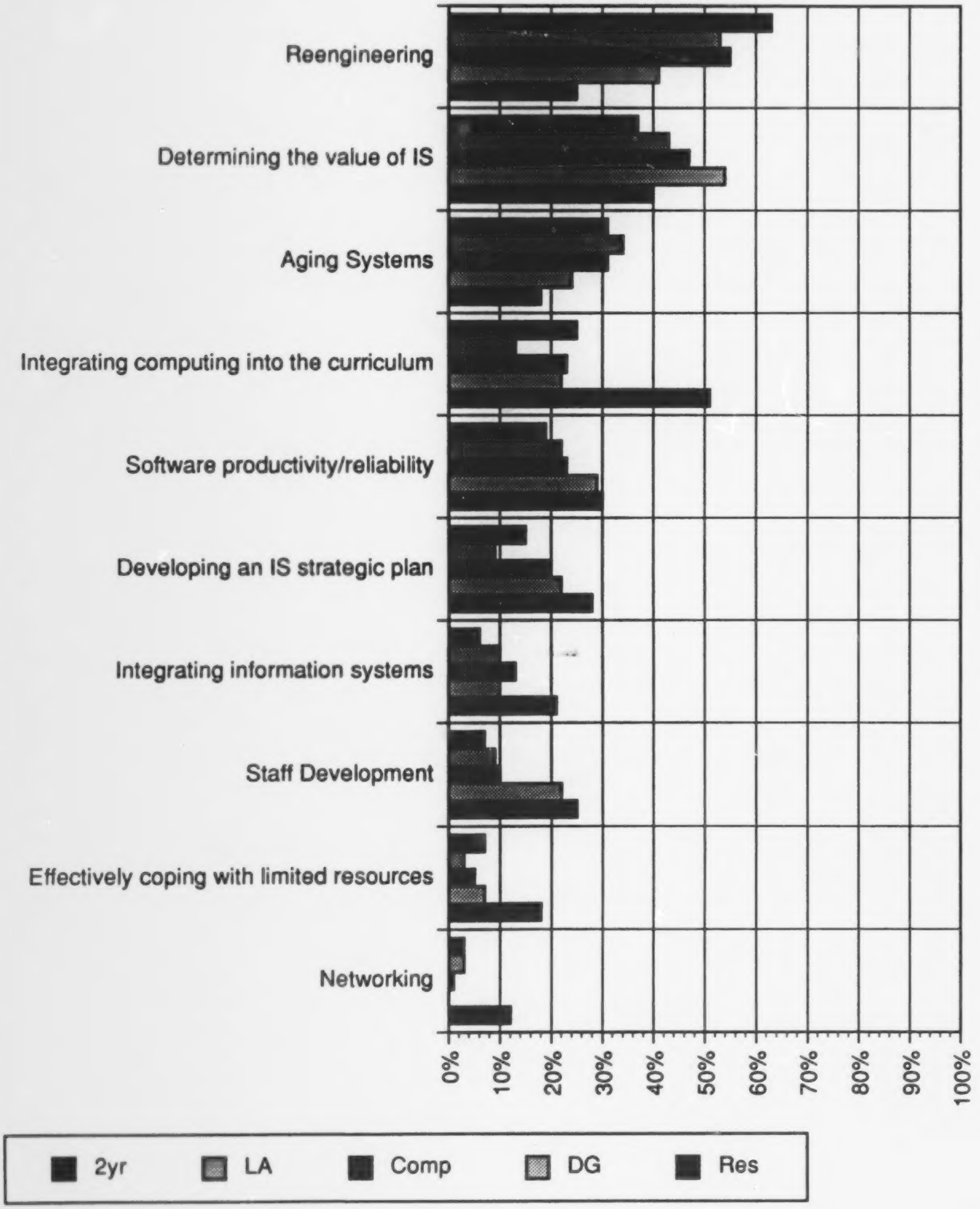
Percent of institutions who ranked all issues ≥ 8 (Bottom Three) by Control



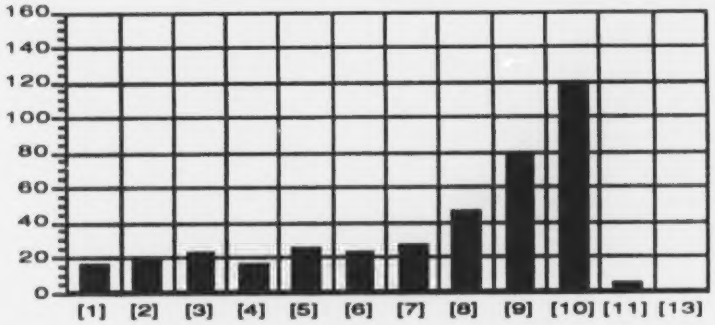
Percent of institutions who ranked all issues ≥ 8 (Bottom Three) by institutional size (FTE)



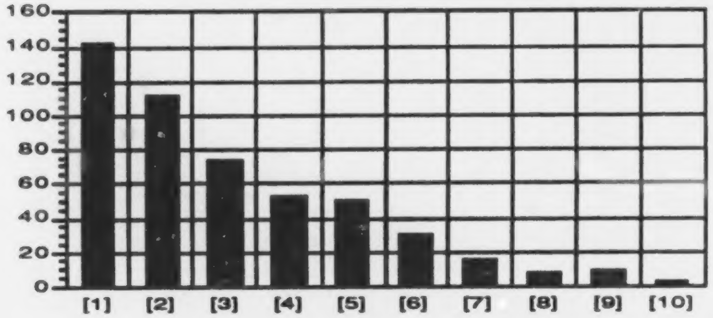
Percent of institutions who ranked all issues ≥ 8 (Bottom Three) by Carnegie Classification



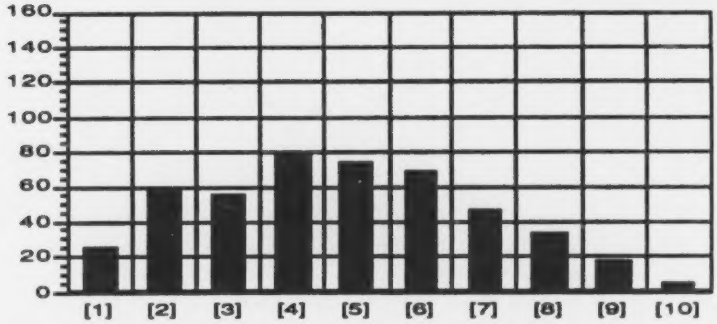
Reengineering (all responses)



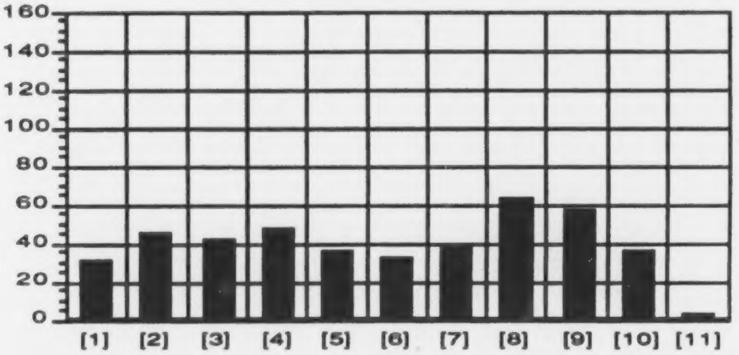
Networking (all responses)

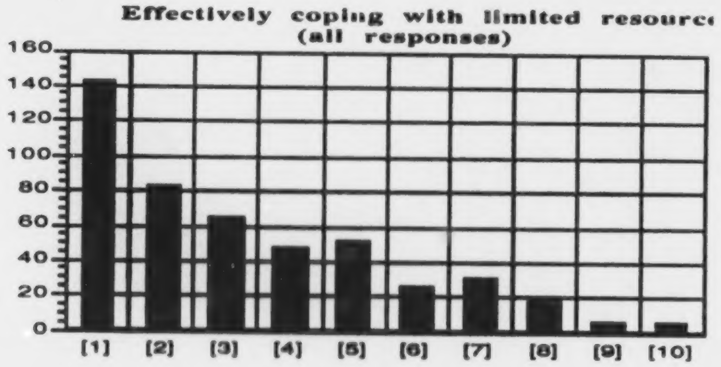


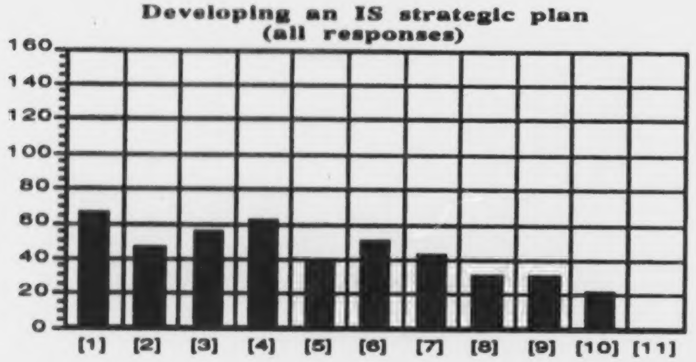
Staff Development (all responses)

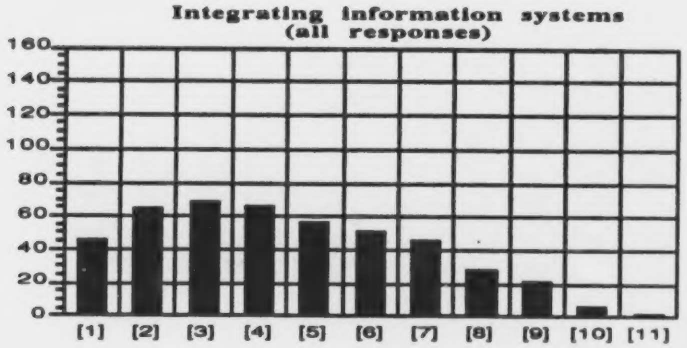


Aging systems (all responses)

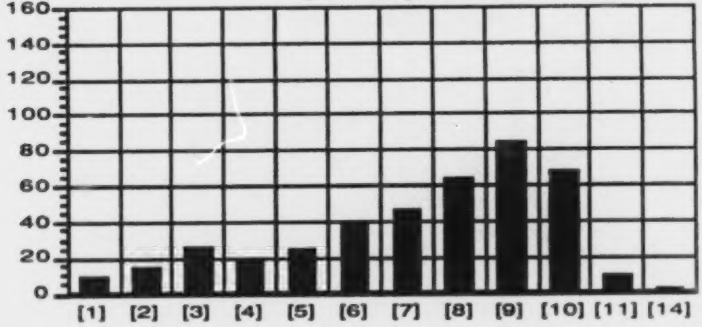



Effectively coping with limited resourc
(all responses)
160
140
120
100
80
60
40
20
0
[1]
[2]
[3]
[4]
[5]
[6]
[7]
[8]
[9]
[10]

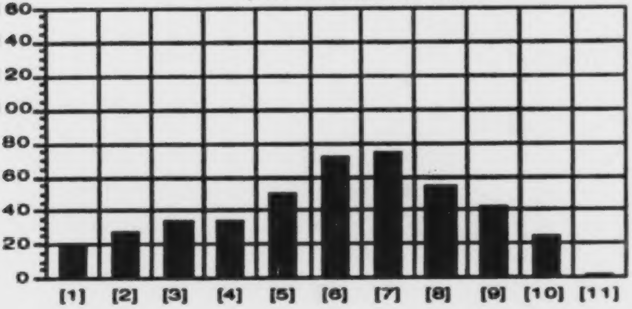

Developing an IS strategic plan
(all responses)
160
140
120
100
80
60
40
20
0
[1]
[2]
[3]
[4]
[5]
[6]
[7]
[8]
[9]
[10]
[11]


Integrating information systems
(all responses)
160
140
120
100
80
60
40
20
0
[1]
[2]
[3]
[4]
[5]
[6]
[7]
[8]
[9]
[10]
[11]

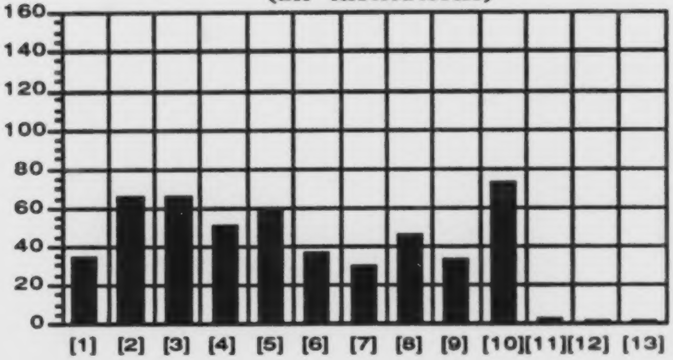
Determining the value of IS
(all responses)



Software productivity and reliability
(all institutions)



Integrating computing into the curricutlm
(all institutions)



Other Responses and Their Rank (Sorted Alphabetically)

Rank	Response
7	academic vs administrative support
5	access to information for institutional management
2	administrative systems & user development and education
2	attracting and focusing good staff
7	centralization, decentralization & other organizational issues
11	client server model
6	client training & documentation
3	client-server distributed applications
3	client/server migration
6	data administration
6	data security vs access
8	debit cards
3	decentralization
4	delivering quality services to all IS customers
11	develop better utilization of Internet
1	developing systems seamlessly on two platforms:IBM CPLUS and "IBM" and MAC micros
11	development of computer assistant learning packages
4	discovering & implementing new solutions
2	distributed computing
10	document imaging
1	downsizing
7	downsizing systems/applications to mini or PC
2	educating upper level management
1	end user application development
7	ethical issues in use of computing
No Rank Given	executive info support, AI, collaborative work, business design & info systems
1	how to become a more responsive & dynamic information technology utility for users
3	image processing
4	Impact of Internet
9	implementing IS strategic plan
1	information architecture
2	Integrating multimedia into the curriculum
3	Integrating the library with other aspects of IS
5	Integrating voice, video and computing
1	keeping up with the pace of change in technology
11	maintaining state-of-the-art as systems grow and age
4	making open systems work
2	managing costs
2	merging of related technologies e.g. library, printing
4	micro/mainframe software integration
2	more effectively education people in the use of technology
5	Multimedia
No Rank Given	obtaining a balance between centralization vs decentralization
7	open systems
3	organization
11	outsourcing
6	paper reduction
2	providing pc s/workstations for faculty & students
1	providing training to growing # of computer users
1	quality management

Other Responses and Their Rank (Continued)

Rank	Response
2	rapid application development
1	rationalizing the role of IT Professionals in curricular decisions
1	reducing service because of insufficient resources
2	security
5	security
11	security
2	staying current with new hard-software
3	student lab modernization
3	telecommunications
2	training
10	Training
1	transformation
4	understanding key trends that effect strategic planning
1	user education
No Rank Given	video, multimedia
6	working with library

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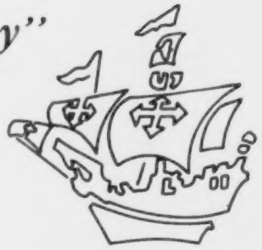

T3-5

Improving User Access to Data with an Electronic Report Distribution System

Linda Avallone-Arkle
Candace Trerotola
University of Massachusetts

IMPROVING USER ACCESS TO DATA WITH AN ELECTRONIC REPORT DISTRIBUTION SYSTEM

Linda Avallone-Arkle
Senior Analyst/Programmer
Univ. of Massachusetts

Candace Trerotola
Senior Systems Analyst
Univ. of Massachusetts

INTRODUCTION:

The University of Massachusetts is comprised of five campuses, at Amherst, Boston, Dartmouth, Lowell and Worcester. The Data Processing Center at the University of Massachusetts handles all administrative student, financial and personnel/payroll data processing needs for the Amherst and Boston campuses; financial and personnel/payroll for Worcester. By July 1992, it is expected that DPC will handle personnel/payroll data processing for the campuses at Dartmouth and Lowell. Centralized Student Systems and Academic applications, which represent most of the examples contained in this paper, only apply at present to the Amherst and Boston campuses. The total enrollment is around 20,000 on the Amherst campus and 15,000 in Boston. The Data Processing Center and our IBM mainframe physically reside on the Amherst campus.

As with most institutions, we had been creating many paper reports, with multiple copies, the actual use of which was questionable at best. Schedulers manually decollated output from various jobs in order to validate totals. We produced reports for data that would be better supplied online, for fear of unwieldy, resource-intensive CICS programs.[1]

There was a lot of paper generated, lots of paper thrown out after a cursory viewing, lots of money wasted. The Data Processing Center had been printing 700,000 pages of one-part paper and 625,000 pages of page printer paper each month. This past year (Fiscal 1991) we spent $58,000 on one-part paper, $26,000 on page printer paper, $12,500 on page printer supplies and $3,500 on printer ribbons for a total of $100,000.

We had to address the issue of how to reduce generating such large quantities of paper; we needed to investigate how these reports contributed toward the mission of the University. We decided that we needed a way to more efficiently and economically manage our reports and their distribution. There were academic departments that received microfiche and paper for the same report because of the delay in getting the fiche. The paper was discarded after the fiche arrived. Detailed reports of hundreds of pages were distributed with abandon; frequently, only parts of the report were actually used. A report combining two or more separate components was often distributed to several users in its entirety, even though only one part was relevant to any of them.

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[1] CICS (Customer Information Control System) is IBM's teleprocessing monitor, widely-used in the mainframe IBM environment. It controls online Data Base/Data Communications applications.

The Registrar's offices were largely responsible for further decollating reports for distribution to academic offices. With many departments requesting reports, this burden was not inconsequential.

In addition, our current procedures did not take advantage of the advances in communications technology that had been installed over the past year. Many users now have mainframe access and remote printers. A print site is located on each campus, and some reports were being printed locally. Many of our larger user reports, however, were still produced on a printer located in the centralized mainframe computer room in Amherst. Each one had to be separated and distributed by a computer operator. This labor-intensive activity often resulted in lost or mislaid reports, which was not well received by the user community.

It was therefore essential that administrative users be introduced to electronic distribution of reports. The excessive generation of paper was originally a secondary issue; the primary dilemma arose due to our computerized degree audit system.[2] The degree audit system had been in full batch production for over a year. Degree audits were created via a batch process, either for individuals or groups of students. The Registrar's offices were the administrators and distributors of the system.

The academic advisers needed the ability to autonomously and dynamically request individual student audits without contacting the Registrar's office. They wanted, as might be expected, to invoke an *online* request for an audit, and be able to immediately view it online and/or print it, while the student was still in the office.

The demand for this capability was the primary driver of the investigation and subsequent acquisition of a report distribution and management facility. The other issues were, fortuitously, addressed by the solution to the degree audit situation.

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[2] We licensed the Degree Audit Reporting System (DARS) from Miami University (Ohio) in 1987.

Our report distribution and management software is ***VIEWCOM***, from StarTech Software Systems, Inc. [3] Other companies also offer this type of software, and this paper will refer to the components and uses as generically as possible. Since our direct experience is limited to ***VIEWCOM***, some of the references will specifically apply to it.

The purpose of this type of software is to expedite access, administration and distribution of reports, in both batch and online environments. It uses the CICS network in managing these tasks.

We have had this package since 1989. In the fall of 1990, it was disseminated to student systems users on the Amherst and Boston campuses, for viewing and printing of degree audit output. The degree audits were submitted as batch jobs by an in-house written CICS program. The output was immediately (or soon thereafter) available for online perusal. In the fall of 1991, online transcripts were implemented using this same technique (referred to, henceforth, as *hot batch*). We continue to find other uses for it. These will be described later.

WHAT IT IS:

It is important to distinguish the actual components and capabilities of the software package from changes that must be made by the data processing staff to make use of it.

The ***report distribution software*** processes reports **after** generation by application programs. It provides the capability of outputting all or part of batch reports to remote, local or PC terminals. It also allows reports to be generated directly through an interactive CICS program. Plain vanilla transmission of batch reports to the facility requires only one job change. The ***SYSOUT*** (output destination) of batch report creation jobs has to be changed to a location (i.e.., class, CICS region, user or group identifier) that has been pre-defined by the system administrator. [4]

The ***user identifier*** is associated with a single individual. Groups of users can also be defined with a group identifier. In this way, the batch reports can be targeted to one or more individuals. The printers available to each user must also be pre-defined, and the user can select any of these printers for hard-copy reports (although one serves as the default). The user and printer list are also maintained by the system administrator.

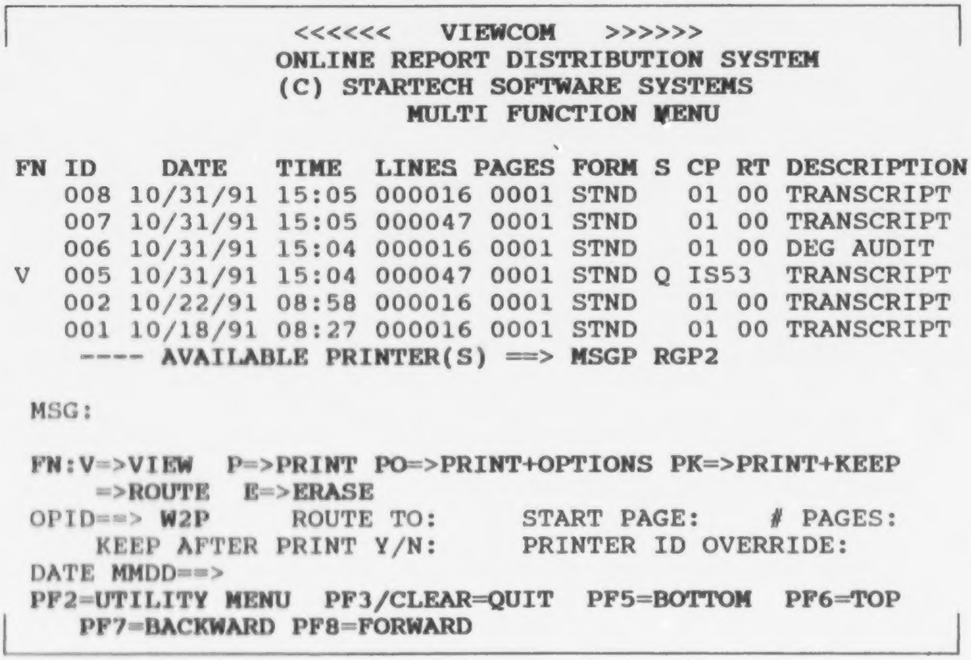
---

[3] StarTech Software Systems, Inc. is located in New York City.

[4] SYSOUT is an IBM term that is used to indicate where the output should go (printer, screen, etc.). SYSOUT=xxxxxx is the abbreviated syntax; xxxxxx is the system-defined *class*. Groups of output can all be assigned to the same class, for use by ***VIEWCOM***.

An online facility allows users to list all of their own reports, and then to view and/or print any of these reports selectively or in their entirety. It also provides user control over report disposition - reports can be purged or routed to other users on the system. Reports can be scrolled, backwards or forwards, and can even be reformatted using cut and paste commands. All reports under the control of the distribution software are stored in a keyed (VSAM) file.

All of these options are controlled through a single transaction. The following shows a list of online reports available to a hypothetical user. The "V" (view) option has been entered in front of report number 005. The description indicates that this is a transcript whose output was directed to and controlled by the software.

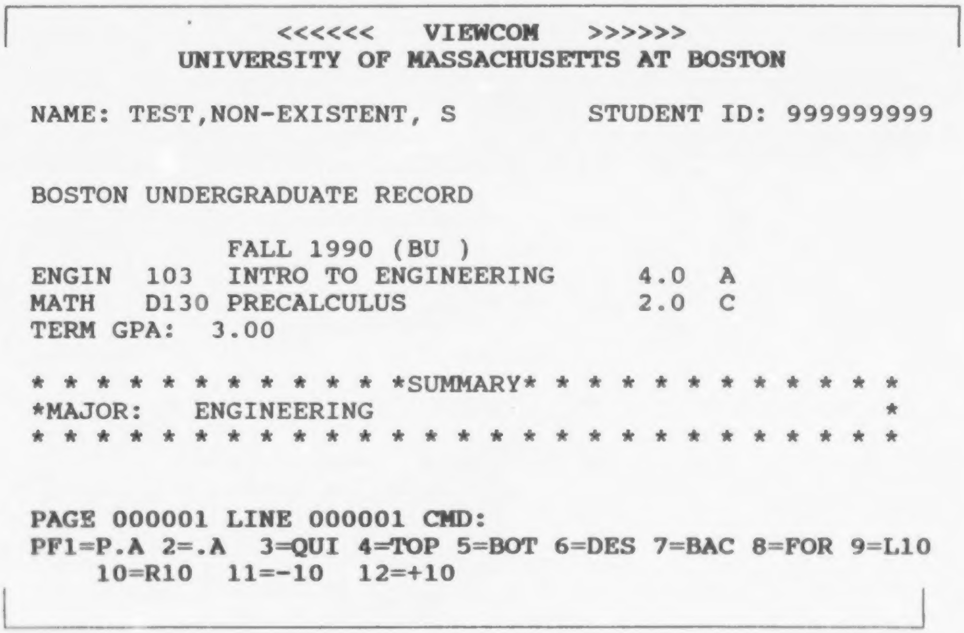


```
                    <<<<<<   VIEWCOM   >>>>>>
                 ONLINE REPORT DISTRIBUTION SYSTEM
                 (C) STARTECH SOFTWARE SYSTEMS
                         MULTI FUNCTION MENU

FN ID    DATE    TIME  LINES  PAGES FORM S CP RT DESCRIPTION
   008 10/31/91 15:05 000016 0001 STND   01 00 TRANSCRIPT
   007 10/31/91 15:05 000047 0001 STND   01 00 TRANSCRIPT
   006 10/31/91 15:04 000016 0001 STND   01 00 DEG AUDIT
V  005 10/31/91 15:04 000047 0001 STND Q IS53  TRANSCRIPT
   002 10/22/91 08:58 000016 0001 STND   01 00 TRANSCRIPT
   001 10/18/91 08:27 000016 0001 STND   01 00 TRANSCRIPT
    ---- AVAILABLE PRINTER(S) ==> MSGP RGP2

 MSG:

 FN:V=>VIEW  P=>PRINT PO=>PRINT+OPTIONS PK=>PRINT+KEEP
    =>ROUTE  E=>ERASE
 OPID==> W2P     ROUTE TO:      START PAGE:    # PAGES:
    KEEP AFTER PRINT Y/N:      PRINTER ID OVERRIDE:
 DATE MMDD==>
 PF2=UTILITY MENU  PF3/CLEAR=QUIT  PF5=BOTTOM  PF6=TOP
   PF7=BACKWARD PF8=FORWARD
```



```
                  <<<<<<   VIEWCOM   >>>>>>
              UNIVERSITY OF MASSACHUSETTS AT BOSTON

 NAME: TEST,NON-EXISTENT, S        STUDENT ID: 999999999


 BOSTON UNDERGRADUATE RECORD

             FALL 1990 (BU )
 ENGIN  103  INTRO TO ENGINEERING      4.0  A
 MATH   D130 PRECALCULUS               2.0  C
 TERM GPA:  3.00

 * * * * * * * * * * * * *SUMMARY* * * * * * * * * * * * *
 *MAJOR:   ENGINEERING                                    *
 * * * * * * * * * * * * * * * * * * * * * * * * * * * * *


 PAGE 000001 LINE 000001 CMD:
 PF1=P.A 2=.A  3=QUI 4=TOP 5=BOT 6=DES 7=BAC 8=FOR 9=L10
     10=R10  11=-10  12=+10
```

In our particular package, there are additional screens for more advanced functions. Some of these are discussed in the next section.

HOW WE USE IT:

At present, we use the software in three different environments, *batch*, *hot batch* and *CICS*.

Batch - In the *batch* environment, we use it to combine parts of two or more related jobs into a single output. The job association might be by application, distribution list, functionality, or whatever. The output might contain the reports in their entirety or might be subsets extracted via a search string. Combinations of job output becomes, effectively, a single report which is then printed and/or routed to CICS for online viewing.

These combined and/or selected reports have to be pre-defined, designating the selection criteria, the printer route list and the user distribution list. The method of establishing pre-defined criteria would obviously differ with the software. With ours, selection is by specific literals appearing in row and column page positions. Conditional selection can be highly tailored, via multiple select statements. The *SYSOUT* statement in the job also has to be modified to associate the related jobs by job class and/or group job id. All of these pre-defined definitions are entered online through the user interface menu. They need only be created once.

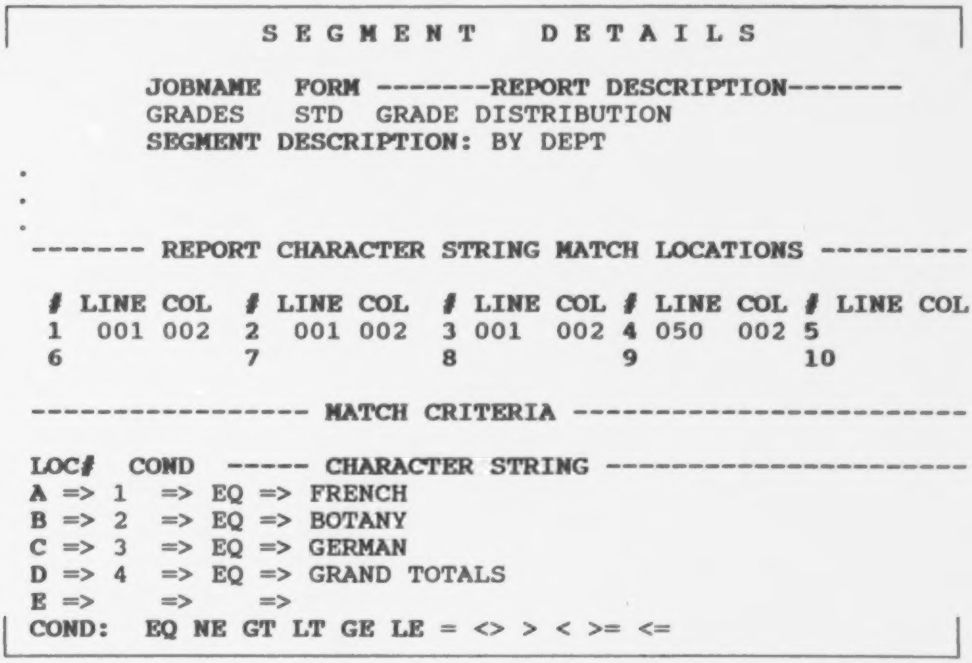
This has saved time for job schedulers by eliminating the manual collection of output for calculating summary totals and/or for distribution to users. Total student record counts for the Student Database are validated by aggregating *add* and *delete* counts from all applicable nightly jobs. All of these jobs were changed to send the output to a common destination (i.e., SYSOUT, and job group identifier). The combined output is then printed in a single job, saving a lot of dreary paper-gathering.

The process that "rolls" admitted students from the Admissions system to the active Database produces separate messages for each of the five registrars. Each registrar used to receive the entire report, even though only a portion was relevant. We now separate the report by selecting on a string which always appears at a particular row/column position. The logically divided output is then ***electronically*** distributed to the appropriate people.

Computer operations uses this same string search technique to select certain tape volume ranges. The full report lists all the tapes in the library, but the operations manager is often concerned with particular ranges of tapes. By setting up parameters to search for specific select criteria, a report can be created containing only this information.

A *planned* use of this facility is to extract intermediate or grand totals from lengthy reports. Chancellors, provosts, academic department heads, etc., often do not want or need the detail of many reports. Rather than running separate reports, or photocopying specific pages, a report can be run one time, in full. The relevant *segments* are distributed, electronically, to the interested parties. One example of this is a massive report that prints grade distributions by course section. With thousands of course offerings, the full report is several hundred pages. Totals by department might be of interest to the academic deans and advisers, while the detail for each course might be relevant to the department heads. The appropriate level of detail will be distributed, once the select criteria are defined, to the appropriate users.

The following is a portion of the vendor's screen for the input of select criteria for this type of segmented reporting.



```
                        S E G M E N T   D E T A I L S

        JOBNAME  FORM -------REPORT DESCRIPTION-------
        GRADES   STD  GRADE DISTRIBUTION
        SEGMENT DESCRIPTION: BY DEPT
 .
 .
 .
 ------- REPORT CHARACTER STRING MATCH LOCATIONS ---------

  # LINE COL  # LINE COL  # LINE COL # LINE COL # LINE COL
  1  001 002  2  001 002  3 001  002 4 050  002 5
  6           7           8          9          10

 ---------------- MATCH CRITERIA ----------------------

 LOC#  COND  ----- CHARACTER STRING --------------------
 A => 1   => EQ => FRENCH
 B => 2   => EQ => BOTANY
 C => 3   => EQ => GERMAN
 D => 4   => EQ => GRAND TOTALS
 E =>     =>    =>
 COND:  EQ NE GT LT GE LE = <> > < >= <=
```

In this case, the job name (eg., identifier) is called GRADES. Location 1 will select all pages of the grade distribution report where "FRENCH" appears on line 1, column 2; Location 4 will select on the literal "GRAND TOTALS" on line 50, column 2.

The same type of search might, in the future, be used for mass transcripts, enrollment totals, and mass degree audits. The output can be printed on remote or local printers, or electronically distributed via the CICS network.

Hot batch - This is job submission through the CICS. A CICS program is invoked by an online transaction, with accompanying parameters. The CICS program builds JCL (job control language) and calls another program to send the job to the queue. The *hot batch* mode is actually independent of the report distribution facility. It is the report output from this hot batch that is controlled by the software.

We currently use *hot batch* for degree audits and transcripts. For degree audits, the user invokes a transaction with the desired student identifier, and a job is submitted to an initiator (as described above) established for this purpose. The output is sent to the pre-established report distribution destination. This destination can be a remote or local printer; the output can also be sent to an online screen for viewing and/or printing. The destination must be predefined in a user route list.

One major problem with *hot batch* is the need for dedicated initiators. If tape mounts are involved, patience might be sorely tried. For heavily-used, time-critical jobs, it might not be an appropriate vehicle. Hot batch does free up CICS resources, however, since the interaction with CICS is fairly minimal. Where results are not immediately required, or if you have a surfeit of unused initiators, this method is great.

CICS (online) - We are also using this software for online class rosters, directly through *CICS*. A CICS application program reads and processes file data. The program then passes the data to the report distribution software. [5] The data is sent all at once to the management facility in lines of 133 characters. The printer route list, report description, and other identifying information are also passed. The application program can direct that the resulting report be printed immediately and/or sent to a screen for viewing. The report is keyed by individual or group identifier. All scrolling and report disposition is handled by the report distribution software.

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[5] Via a CICS "Link"

With an application such as class rosters, where the enrollment in a course could range from a handful to several hundred, there are definite benefits. Files only have to be accessed one time, regardless of the number of records. The application program itself is very simple. It only has to read the file into a communications area and pass that information along. The program will be notified of the success (or failure) of the report creation. The user then can bring up the report for viewing. Several class rosters can be requested at a single time, provided that the multiple selection capabilities have been included in the application program.

Using the report distribution software to handle scrolling, reformatting, printing, etc., eliminates the necessity of writing application programs for this purpose. Within CICS, it does mean that two transactions have to be invoked, one to initiate the request, one to view the output. This could potentially be avoided by having the application program invoke the second transaction automatically.

Any report distribution software should handle all of these methods equally well. Hot batch, obviously, requires one or more initiators. With heavily used applications such as ours, the waiting period for job initiation would quickly dilute the appreciation for the package. For online reporting applications, we are leaning towards direct CICS access.

File management and online display of the generated reports is controlled entirely by the software. Access to the generated report is invoked by a single CICS transaction. The reports themselves are stored in a VSAM file. When the user enters the transaction, all the reports under that user's identifier are displayed. The user selects one report for processing (viewing, printing, routing, deleting). All normal editing functions, including scrolling, string search, cut and paste, are available.

SECURITY:

As mentioned above, all user identifiers (both individual and group) need to be added to a pre-defined table. One or more printers are associated with each identifier; the default printer is the first one in the list. The table containing this information then has to be reassembled by the Technical Support staff.

Our report distribution software interfaces with security packages; we do not use this facility. The applications or system security software control any security at the user level. Security certainly might vary among packages of this type. As mentioned previously, the user output is automatically secured, since it is directed to the pre-defined or initiating user, and is under control of that user.

In this way, report distribution software may actually lessen existing security concerns, since it eliminates the likelihood that hardcopy reports will end up in the wrong hands. With many packages, there is also an audit trail of report distribution targets.

NETWORK ENVIRONMENT:

One important consideration in the changing computer environment is communicating across networks. Our mainframe IBM hardware is centralized, but we are connected to the Boston campus through RJE (remote job entry) communications. All of Boston's batch data had been transmitted to their VAX using RJE telephone lines. Other users had a direct mainframe connection, or were connected to the mainframe through dial-up. There was (and continues to be) no defacto or mandated standard for local printers or for mainframe connectivity.

It was critical that any report distribution facility be able to work without regard to the external hardware. Other operating systems were also a consideration. The connectivity issue was paramount in exploring the boundaries of user reporting. Had we been in a consistent environment (i.e., totally IBM), connectivity would not have been as much of a problem. But, with at least four different environments, we needed a common link. The obvious answer was the CICS network, which, theoretically, would solve the problem. The realities of connecting several different environments soon became evident.

In the past, non-IBM users were connected to the mainframe only through dial-up. In investigating the user environment, we discovered VAX - VMS users, UNIX users and users of NOVELL LANs. Printers attached to these computers and terminals also varied.

In order to allow users direct mainframe access through the CICS network, these users had to be connected through a gateway. We acquired a DEC SNA gateway and protocol converters to accommodate these non-IBM users. All printers, both PC and CICS, had to be addressable to CICS. With PC printers, the protocol converters were used to associate a printer id with a terminal id. These actions were originally taken to address the mainframe connectivity issue, and specific details of this conversion are not pertinent to this paper.

Accessibility is an important element. If electronic report distribution is to work, it may require expenditures and activities in improving the CICS network. While these hardware installations were not specifically undertaken to allow a networked electronic report distribution, it would absolutely have become necessary. Do not underestimate this issue. Unless your environment is highly controlled, highly static and subscribes to a single vendor, this will need to be addressed.

FUTURE USES:

In the Human Resource system, the payroll register, a four hundred page report, is printed weekly. This will soon become an online report for perusal by Human Resources personnel. It will be automatically deleted at the end of the week.

We also have a system that maintains the amount of time that the programming staff has spent on various tasks and applications. Fifteen jobs are run each week; the output must be collected, decollated and merged manually. By using the bundling facility, these can be printed as a single report at the end of the night.

Accounting reports are printed monthly with a combined output of twenty thousand pages. This will be segmented (by department) and distributed online to the appropriate parties.

Another goal is to bundle reports of some administrative departments, such as Housing and Admissions, into a single departmental output. Our report distribution system has the capability of providing a table of contents at the beginning of a bundled report. The departments, rather than the computer operators and schedulers, would be responsible for separating the report.

SUMMARY:

In looking for a report distribution package, we researched nine software packages. Our functional requirements included the ability to print batch output on remote/local/PC printers, as well as on system printers; to be able to view output online prior to printing; to allow string searches, to reformat output, print partial output; to limit user access to those reports initiated by that person; and, to perform all of these tasks without changes to existing applications programs.

It is important to weigh your own requirements and expectations. None may meet all your needs - not all products have an online interface, and not all are easy to use. Packages for IBM machines usually run under TSO, CICS or VTAM. The software environment should be your first prerequisite, and will allow you to immediately eliminate non-contenders. You may want to interview end-users about their requirements. You certainly want to enlist the aid of Technical support and Operations personnel.

Security should be part of any good report distribution software. Users should be able to only view or dispose of their own reports. Maintenance of reports should be easy to use. Automatic retention handling, and archiving flexibility should also be factors in your decision. Consider future uses of the product. Downloading to a PC might not be part of your immediate game plan, but it could become important later on.

Staffing issues should also be considered. Technical support staff will be needed for installation and connectivity matters. Someone will have to maintain the user tables, and be responsible for general support.

Once you have selected some possible candidates, bring them in for a trial period. You will not be able to simulate all conditions, but you will be able evaluate some of the negative and positive aspects. If possible, go on a site visit, so you can see the product in action. Make sure that vendor support is satisfactory. Start with an application that will be well-received. For us, online degree audits had not previously been available, so the users were given something they never had before.

Once installed, remember that electronic report distribution can represent a major change in philosophy. Users, even today, are sometimes uncomfortable and untrusting of electronic data storage, and reluctant to give up paper output. This facility does place control of reports with the users, and may, if presented right, actually increase user satisfaction.

And, finally, be aware that this may not be an inexpensive proposition. Prices of report distribution software range from $7,000 to over $70,000. You should be prepared for training costs, as well as extra disk space for active and archived reports.

Attachment: Current DPC Networking Environment Diagram

37th Annual College and University
Computer Users Conference

"Discover New Worlds With Technology"

T4-1
Factors Influencing the Rate of Implementation of Computer-Assisted Advising Systems

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Factors Influencing the Rate of Implementation of Computer Assisted Advising Systems

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In the early 1980's, Miami University in Oxford, Ohio, began development of the *Degree Audit Reporting System* (*DARS*). This software matches a student's courses with the requirements for their anticipated degree program. It is commonly referred to as degree audit since it audits a student's progress toward completion of a degree.

DARS was initially developed for sole use by Miami University. However, by January 1985, the system was modified by removing the Miami specific code from the core program. These changes facilitated making the software useful to other institutions (Southard, 1988). Institutions which license the Miami product, however, need to do several things before the system is made to be fully operational. Until the 5.1 release, the schools needed to develop the on-line screens for data entry of the degree requirements. Currently, new licensees still need to write the interface between *DARS* and the institution's existing student record system, which is where student course and grade data is stored. Implementation generally requires support from academic, administrative and technical offices within an institution of higher education.

This paper will focus on the critical steps of the implementation process for a computer assisted advising system with particular emphasis on the *DARS* product. It will briefly review the development of computer assisted advising systems and the *Degree Audit Reporting System*. It will also cover the results of a pilot study which sought to determine the primary areas of concern for administrative and technical coordinators and those implementation factors which are of significant concern to both areas of personnel. Finally, it will provide recommendations on implementation practices and processes.

Computer Assisted Advising

HISTORY OF DEVELOPMENT

The first attempts at developing a computerized degree audit system occurred at the University of California at Berkeley in 1968 (Rose, Armstrong and Zavadsky, 1990). The Miami University *DARS* software was predated on that campus by a rudimentary degree progress system whose use was discontinued in 1968 when the mainframe computer was replaced by a more current system (Southard, 1984). Winston and Ender (1984) have also written about the history of the development of computer assisted advising systems. According to these two authors, Purdue University also began to produce a form of a degree audit report shortly after Berkeley and Miami introduced theirs. By the middle of the 1970's, Georgia State and Brigham Young had initiated work on their mainframe application advising systems (Spencer and Petersen, 1983).

CURRENT SYSTEMS

According to McCauley and King (1991), presently, there are at least nine vendors marketing advising or degree audit systems. American Management Systems (AMS) markets the Miami University *DARS* product as part of its student information system package, but *DARS* is still directly available from the institution itself. Brigham Young University licenses a degree audit algorithm for a mainframe environment. Computer Management and Development Services (CMDS) offers a system. Information Associates (IA) markets *ON-COURSE* as part of their Student Information System (*SIS-PLUS*). Georgia State and North Carolina State both offer systems, as does Systems Technology Corporation. Finally, Iron-Soft Ltd. licenses *Academic Audit* which is a degree audit system designed to be run on personal computers.

Today's computer assisted advising systems vary in terms of their functionality and adaptability. Features found in some of these systems include the ability to complete major shopping, develop tailor-made audit programs and track multiple components of degree program requirements. Most programs can track multiple degree program requirements based on differing catalog dates or specified date ranges. Advising system algorithms often also include processing for exception records in order to store approved student adjustments to the degree program rules as specified by the auditing system.

All of the systems offered by the vendors listed above produce audit reports which list out, to varying extents, the degree requirements students have completed and have yet to finish. Several of these packages have also been modified to take advantage of the multiple printing options available with the use of laser printers. One should note, however, that some of the features found in the various computer assisted advising systems are only operational in either batch or on-line reporting requests. An understanding of these types of system limitations should be considered by institutions preparing to license an advising system.

DEGREE AUDIT REPORTING SYSTEM

The *Degree Audit Reporting System (DARS)*, offered by Miami University, is currently available in the 4.4 series of the software. Recent versions of this system are produced in both the PL/I and COBOL languages. In addition to offering the standard features of degree progress checking, exception processing and graduation analysis, the more recent versions of the software include pre-packaged screens and expanded driver programming options. The current licensing fee is $17,500.00 (J. Southard, personal communication, January 2, 1992). These two options alone may assist an institution in reducing the amount of time needed to implement the degree audit system.

Miami University provides assistance to its licensees through several mediums. An annual users-group meeting is held every summer which includes sessions for both administrative and technical staff. An advanced rule writing seminar is sponsored each year to assist those individuals with encoding responsibilities. Also, several other workshops are offered throughout the year for recent licensees and for those investigating advising system options. Telephone support and help through the *Degree Audit Reporting System Listserve (DARS-L)* are also offered to those schools which pay the annual maintenance fee (which is ten percent of the current licensing charge).

Implementation Factors

PILOT STUDY METHODOLOGY

In March of 1991, the author sent notes out on both the DARS-L and CUMREC-L listserves on BITNET network (the Because It's Time Network). DARS-L is maintained by Miami University for licensees of their degree audit system. CUMREC-L is maintained for the attendees of the College and University Computer Users Conference. The notes asked subscribers to identify what they believed to be the five to ten institutional factors which influenced the rate of implementation of computer assisted advising systems. While only two responses were received from individuals who were only subscribers of CUMREC-L, eighteen of the seventy-three DARS-L subscribers responded.

The responses from the twenty respondents were translated into simple statements and coded to indicate whether they were provided by an administrative or technical coordinator involved in advising system implementation. Ten sets of responses were provided by administrative coordinators and the remaining ten sets by technical coordinators. This process lead to identifying 220 simple statements which described the factors and subfactors which were believed to impact the rate of implementation of such systems. Ninety-six (forty-three percent) of the simple statements were provided by the technical coordinators and the remaining 124 (fifty-seven percent) by the administrative coordinators. In order to make the data more manageable, a modified process of semiotic analysis (Center for Educational Policy and Management, 1974) was used to subsume similar statements. This activity resulted in the translation of the 220 simple statements into identification of five basic categories which the administrative and technical coordinators identified as containing the factors which impact the rate of implementation. These five categories, 19 factors and numerous corresponding subfactors are discussed in detail below. The following sections also compare and contrast the views of the administrative and technical coordinators on these implementation factors.

AVAILABILITY OF RESOURCES

The respondents to the initial survey indicated that the presence or absence of three specific resources greatly influenced the rate of system implementation. The three resources identified were staffing, training and the time to work on the project. One consideration which both the administrative and technical coordinators seemed to agree upon was the underestimation of time required to implement the system by both types of supervisory personnel. Both kinds of coordinators indicated that a lack of understanding of the complex nature of the *DARS* product on behalf of managerial staff led to a number of problems. Administrative coordinators indicated that this knowledge gap made it difficult to acquire release time for training and for rule writing. Technical coordinators expressed that this gap also inhibited their ability to secure sufficient time for screen development and driver program modifications, as well the ability to find time to assist the administrative coordinators with rule writing duties. Finally, according to several of the administrative coordinators, institutions preparing to implement should consider how institutional size and the state of the current student information system may impact the time required for implementation. Based on the responses provided by the coordinators, these are factors which should not be overlooked if an institution wants to develop a realistic implementation plan.

Training was another resource issue identified by both administrative and technical coordinators for computer assisted advising systems. However, while administrative coordinators often discussed training for end-users (students, advisors) in their responses, the technical coordinators seemed to be more concerned with training for themselves on the *DARS* product. Several technical

AVAILABILITY OF RESOURCES

IMPLEMENTATION FACTORS AND SUBFACTORS	FACTOR INFLUENCE	ADMINISTRATIVE CONCERN	TECHNICAL CONCERN
Time Allotted to Project		*	*
underestimation of time needed to implement by supervisory personnel	inhibit	*	*
lack of understanding of product complexity	inhibit	*	*
inability to acquire release time for training and rule writing	inhibit	*	
insufficient time allotted for screen development and driver program modifications	inhibit		*
Training		*	*
available for end-users	enhance	*	
available for technical support staff	enhance		*
ability to send staff to users-group meetings	enhance		*
Staffing for Project		*	*
adding *DARS* duties to current staff agendas	inhibit	*	*
hiring new staff to support administrative and technical *DARS* work	enhance	*	*
Funding		*	*
lack of understanding of on-going operational costs	inhibit	*	
cost of in-house programming support	inhibit	*	
overlooked hardware and printing expenses	inhibit	*	

APPROACHES TO IMPLEMENTATION

IMPLEMENTATION FACTORS AND SUBFACTORS	FACTOR INFLUENCE	ADMINISTRATIVE CONCERN	TECHNICAL CONCERN
General Implementation Approach		*	*
clearly outlining political responsibilities	enhance	*	
effective rule writing strategy	enhance	*	
access to decision makers at all levels	enhance	*	
presence of a campus-wide users group	enhance		*
reasonable and modular implementation plan	enhance		*
implementation plan based on user needs and nature of institution	enhance		*
willingness to make compromises in process	enhance		*
Communication		*	*
avoiding dependence on one staff member for information	enhance	*	*
able to provide info to all parties involved	enhance	*	*
use of a computer-literature, administrative staff member as liaison	enhance	*	*
Problem Solving Strategy		*	*
able to resolve academic policy questions	enhance	*	
institution willing to contact off-campus personnel for assistance with transfer credit module and systems design	enhance		*
Test Procedures		*	*
academic advisors able to check audit reports	enhance	*	
reasonable timetable for bringing in new student populations	enhance		*
selection of an appropriate test department	enhance		*

BEST COPY AVAILABLE

coordinators responded that they felt that it was very important for them to attend the workshops and users group meetings offered by Miami University. However, a couple of the technical coordinators also acknowledged that this need for attendance at the users-group meetings was based on the difficulty they encountered in understanding of the *DARS* documentation.

Staffing for project implementation was identified as the most significant of the resource requirements by both the technical and administrative coordinators. Both groups acknowledged that when there was a lack of staff resources allotted to this project, the progress toward complete implementation was extremely slow. Personnel are required to complete the rule writing, exception processing and student record data backloading in some cases. One practice which was repeatedly cautioned against by both the administrative and technical respondents was the adding of *DARS* responsibilities to the agendas of people who already had substantial existing duties. Several respondents suggested hiring one new administrative and one new technical staff members to provide on-going support for the project and to limit other responsibilities which might be given to them over the course of time.

Finally, while funding is not always defined as a resource, its presence or absence can also greatly facilitate or inhibit progress on any project. Purchase of a system such as *DARS* has an obvious initial expense associated with it. However, the respondents indicated that several of the on-going operational costs were frequently overlooked in early project planning. The costs and responsibility for charges from in-house programming support, additional hardware (i.e., terminals for rule writers), and audit report production and distribution need to be determined prior to implementation. While several technical respondents acknowledged the importance of project funding, it was primarily a concern of administrative respondents.

APPROACHES TO IMPLEMENTATION

The general approach taken toward implementation of a computer assisted advising system was the single most important factor which most influenced the rate of implementation according to both the administrative and technical respondents. Somewhat surprisingly, the administrative coordinators limited their comments in this area to the general areas of outlining political responsibilities for the project and approaches taken toward rule writing. One administrative coordinator also expressed a need for the implementation team to have access to decision-makers at all levels.

The technical coordinators, on the other hand, provided responses concerning implementation approaches which were much broader in scope. Their comments included the recommendations that a campus-wide users group and project team be brought together and charged with the responsibility for the creation of a reasonable, and somewhat modularized, implementation plan. Their belief was that this implementation group should have a high level of commitment and include someone in a key decision making role within the institution. The implementation plan itself should also be appropriate for the institution, which may mean centralized rule writing on some campuses and decentralized rule writing at other institutions. In addition, while the technical respondents acknowledged that project should be user-driven, based on the needs of the academic units, they also expressed that there would be a need for compromises on behalf of the end-users, the administrative staff and the technical personnel. However, while understanding that compromises and changes may be necessary, the technical respondents did encourage sticking to the original implementation plan whenever possible.

Both the administrative and technical coordinators also discussed how communication and approaches to project problem solving influenced the implementation process. The process and structure for communication of concerns surrounding the advising system was identified as an issue. It was recommended that the communication mechanism be able to provide information to all parties involved and also designed to avoid dependence upon a single staff member for information and interpretation. One technical respondent suggested the inclusion of one or two computer-literature, but administratively assigned, staff members on the implementation team to serve as a liaisons between academic, administrative and technical personnel. This approach might be helpful in general problem solving, or even in the determination that assistance may be required by outside experts.

The respondents, however, revealed that what is considered a problem by the technical personnel may not always be a concern of the administrative staff and vice versa. In discussing problem solving, the administrative coordinators focused their comments on the resolution of academic policy questions and rule writing. The technical respondents commented on the institutional willingness to contact individuals on other campuses for help with transfer credit systems and prototyping in systems design.

Lastly, while the administrative coordinators discussed the testing of rules as a significant concern, the technical coordinators were most interested in how the choice of test populations might impact implementation. The administrative coordinators indicated that having professional staff academic advisors (or faculty with significant advising responsibilities) available to check audit reports was extremely helpful. None of the technical coordinators indicated that this was a concern to them, but several did mention the need for the implementation plan to include a reasonable timetable for bringing in new student populations in to the system for test. Two of the technical coordinators also suggested that the first user department be selected very carefully based on the simplicity of degree requirements and a willingness to participate with a system in development.

STATUS OF CURRENT SYSTEMS AND TECHNICAL SUPPORT

The status of the existing student information record system greatly influenced the rate of implementation of computer assisted advising systems according to both administrative and technical coordinators. When providing responses regarding the presence of a student information system, administrative coordinators expressed interests in whether the system was complete, accurate, and centrally located. They also identified the system's capabilities to be modified, store transcript data and offer adequate program identification fields for use with *DARS* as being important. Technical coordinators also expressed concerns over the amount of modification required and the complexity of current student information system. However, it was a technical coordinator who pointed out that the cost of modifying and adapting the student information system should be an item for consideration by those preparing to implement *DARS*.

If the institution has a large number of transfer students enrolled, the presence or absence of a transfer credit module to interface with the advising system will also be a factor influencing the rate of implementation. Several issues surrounding the impact of having to manage transfer credit data in conjunction with an advising system were raised by administrative and technical respondents. Coordinators with primarily administrative responsibilities expressed concerns about how a transfer credit module might process courses for which no institutional course equivalency may be assigned. They also indicated an interest in how the transfer credit data is stored; whether it is available on a mainframe or personal computer system and whether it is stored is a summary or detailed format. In addition, one administrative respondent acknowledged that the lack of a transfer credit module might also cause an increase in the number of exceptions processed through the advising system.

In discussing the need for a transfer module to accompany an advising system at some institutions, the technical coordinators revealed concerns about the number of changes needed to the current student information system in order to facilitate processing of non-native coursework. They also expressed some frustration with what was described as the complicated nature of transfer requirements and policies that were difficult to simulate. This was a primarily a concern of technical staff who were at institutions were the transfer credit decisions were made on a decentralized basis.

Beyond their concerns about the status of the existing student information system and the presence or absence of a transfer credit module, administrative coordinators also seemed to be particularly interested in the functionality of the on-line advising system and the general institutional approach to computing. This interest in the on-line system is understandable since it appears that administrative coordinators often have more responsibility for rule writing duties than do the technical coordinators. The length of time needed to develop user-friendly screens for data entry and maintenance and the time needed to enter full production status were both identified as concerns. The amount time needed to become acclimated to a mainframe system environment was also regarded, by the administrative coordinators, as element influencing the rate of implementation.

In providing responses related to the institutional philosophy of computing in general, the administrative coordinators discussed matters associated with previous institutional experiences with both purchased and school-developed software and how these experience influenced the development of the implementation plan for the advising system. One respondent cautioned that lack of careful pre-purchase or pre-development of software might greatly inhibit progress toward complete utilization of such a system.

Both the administrative and technical coordinators expressed concern over the availability of technical support for the project. The inability to keep programming support assigned to the project was expressed to be an important matter by both types of respondents. Since advising software is often found to be ever-evolving, greatest utilization is limited when technical resources are only allotted for the initial implementation effort. One administrative coordinator indicated that she believed this was because this type of project was frequently given a low priority among all of the institutional computing commitments. A technical coordinator indicated that he believed programming resources assigned to this project were limited simply because of the cost associated with them.

STATUS OF CURRENT SYSTEMS AND TECHNICAL SUPPORT

IMPLEMENTATION FACTORS AND SUBFACTORS	FACTOR INFLUENCE	ADMINISTRATIVE CONCERN	TECHNICAL CONCERN
Current Student Information System		•	•
not in existence or decentralized	inhibit	•	•
present and complete, accurate and centrally located	enhance	•	
system capable of data storage, offering sufficient fields, and modification	enhance	•	
extensive modification required of SIS	inhibit		•
cost of modifying SIS	inhibit		•
Transfer Credit System		•	•
large numbers of transfer students	inhibit	•	•
presence of a transfer credit module	enhance	•	•
inability to assign equivalencies for non-native coursework	inhibit	•	
summary format for transfer credit data storage	inhibit	•	
large number of exceptions required	inhibit	•	
On-Line Advising System		•	
presence of user-friendly screens	enhance	•	
rule writers comfortable with mainframe environment	enhance	•	
General Computing Philosophy		•	
bad experiences with other purchased programs	inhibit	•	
lack of pre purchase evaluation of software	inhibit	•	
Technical Support		•	•
inability to keep programming support on project	inhibit	•	•
low priority of project among data processing assignments	inhibit	•	
cost of technical support	inhibit		•

EXPECTATIONS OF ACADEMIC UNITS

IMPLEMENTATION FACTORS AND SUBFACTORS	FACTOR INFLUENCE	ADMINISTRATIVE CONCERN	TECHNICAL CONCERN
Rule Writing Expertise		•	•
staff able to define catalog text into rules	enhance	•	
academic requirements expressed clearly in catalog	enhance	•	
support from catalog compilers and interpreters in rule writing process	enhance	•	
appreciation of catalog nuisances among rule writing staff	enhance	•	
sufficient time allotted to rule writing task	enhance	•	•
rule writers having clear understanding of *DARS* programming	enhance		•
lack of product understanding	inhibit		•
willingness to contact off-campus personnel for assistance with task	enhance		•
Academic Policies		•	
major curriculum changes during implementation process	inhibit	•	
presence of multiple curriculum committees and grading systems	inhibit	•	
flexibility and compromises accepted by academic units	enhance	•	

NATURE OF INSTITUTIONS

IMPLEMENTATION FACTORS AND SUBFACTORS	FACTOR INFLUENCE	ADMINISTRATIVE CONCERN	TECHNICAL CONCERN
Institutional Structure		•	•
highly decentralized	inhibit	•	•
academic deans support project to implement	enhance	•	
presidential support available for project	enhance		•
Change Capabilities		•	•
willingness to accept change and compromises	enhance	•	•
lack of support from departments using old advising systems	inhibit	•	
advisor apathy	inhibit	•	
preference among advisors for personal computer applications	inhibit	•	
perceived need for an advising system	enhance		•
presence of an older advising system	inhibit		•
view of system implementation as a part of planned change	enhance		•
Advising Process		•	•
renewed institutional commitment to improve advising efforts	enhance	•	
state mandates to improve advising	enhance		•
increased understanding that advising is sometimes subjective and does not always meet student needs	enhance		•
Accountability Mandates		•	•
fear system may expose low graduation rates	inhibit	•	
fear system may reveal easy degree programs	inhibit		•

EXPECTATIONS OF ACADEMIC UNITS

According to the respondents, most of the resistance encountered in the academic units (individual colleges, schools, divisions within a college or university), to the advising system, was focused on rule writing considerations. Administrative coordinators discussed how rule writing, the interpretation of catalog requirements into the coded system of data entry specified by the advising system, was largely a process of definition. They revealed a need for academic requirements to be expressed more clearly in order to facilitate translation into system rules. Several administrative respondents also recommended that the catalog compilers (authors, editors) and the catalog interpreters (advisors, faculty) need to provide assistance to the rule writers in order to ensure the accuracy of the rules definition process. The ability of the rule writers to be sensitive to the nuisances of the catalog and the policies contained within was identified as being a key attribute of competent project personnel by the administrative respondents.

Both the administrative and technical coordinators who responded indicated that sufficient time needs to be allotted for the rules writing process and that competent staff must be selected for this task. Technical respondents repeatedly identified that the rule writers understanding of the advising system and its general programming philosophy was a factor which influenced the rate of implementation. Lack of product understanding was identified as something which could greatly slow full operationalization. Coordinators with primarily technical responsibilities also expressed a need for developing an institutional willingness to contact off-campus personnel for assistance in rule writing when appropriate.

Finally, under the heading of expectations of academic units in the advising system implementation process, other academic policies and degree program exceptions were also revealed to be concerns of the administrative coordinators. The fact, that, at some institutions, the academic requirements are in a state of constant fluctuation was an issue. Major curriculum changes may slow the implementation process; and when an institution has multiple curriculum committees and policy interpretation bodies, the progress is even slower. Some schools have multiple grading systems which must be accommodated for by the advising system. The expectation of the academic unit personnel that the advising system will be capable of handling all these institutional nuisances may be why several administrative coordinators suggested a need for flexibility and compromise in the interpretation of academic requirements and for a mechanism to address these matters as they arise.

NATURE OF INSTITUTIONS

Organizational structure of an institution is likely to impact the rate of implementation according to both administrative and technical personnel. If the institution is highly de-centralized, it means that the support for the project, the corresponding commitment and the placement of priorities will need to come from several sources as opposed to a limited few in a centralized environment. Administrative coordinators reported that they believed support from the academic deans was crucial while technical coordinators emphasized support from the school's president. Both types of respondents indicated that the institution should be organized to provide this kind of project with sufficient funding and support until the implementation is completed.

The institution's ability to adapt to change was also identified as a factor for concern by both administrative and technical personnel. As mentioned earlier, both types of coordinators indicated that an institutional willingness to accept compromise facilitated the implementation process. However, administrative coordinators pointed to matters such as the lack of support from departments using older advising systems, advisor apathy and disinterest in learning to use systematic advising tools, and preference among advisors for using personal computer systems instead of those found in the mainframe environment as being the change factors which influenced the rate of implementation. On the other hand, technical coordinators discussed the perceived need for a computerized advising system, the presence of an existing advising system, and the view of implementation as part of planned organizational change as some of the determinants in the implementation process.

Finally, both administrative and technical coordinators expressed an interest in how institutional advising procedures and a call for greater accountability in higher education may influence progress on this type of project. One administrative coordinator expressed a fear of how this type of system might be used to expose low graduation rates while one technical coordinator indicated a concern about how advising systems might reveal easy degree programs. Another administrative respondent indicated that the advising system was being developed in response to a renewed institutional commitment to improving student advising and retention. Several other technical coordinators explained that the rate of system implementation was being influenced by state legislative mandates for improving advising, presidential attempts to get faculty involved in the advising process, and an increased understanding that traditional advising services some student populations very poorly and that it can be excessively subjective in nature. All of these implementation factors are worthy of further study for those institutions preparing to license a computer assisted advising system.

Recommendations for Implementation

Southard and Savely (1989) acknowledge that the implementation and development of a computer assisted advising system can be a complicated and uncertain process. There are relatively few systems which produce reports that have such extensive campus-wide visibility and the initial investment in such a system is not an inexpensive one. Therefore, Southard and Savely, among others (S. Nickel, personal communication, March 20, 1991; J. Terry, personal communication, December 17, 1991) recommend the careful development of a comprehensive implementation plan before the first rules are written. Indeed, this may be the single most important factor for successful implementation. The implementation plan and approach are the road map which the administrative and technical coordinators will follow as they operationalize the system. Like a map, the implementation plan gives them direction and provides them with a destination to reach or a tangible goal to achieve.

Another key consideration is the development of an institutional understanding and appreciation of the complexity of a computer assisted advising system. Several of the technical coordinators repeatedly gave responses which focused on the time it takes to make this system operational and the high level of intelligence and patience required among implementation team members. The implementation period may well be a very intense time for all parties involved.

Based on the research completed in preparing this paper, the author makes the following recommendations to others preparing to implement a computer assisted advising system:

- Secure the personnel resources to implement the system before undertaking such a project. The ability to provide release time to both administrative and technical project leaders for up to one full year is essential.

- Computer assisted advising systems often have operational costs which get overlooked. Identify the means for distributing reports to students and advisors, and who will incur the printing and postage costs before implementation. Also identify which office will be charged with the system maintenance fees if such services are determined to be necessary.

- Update the current student information system before beginning the implementation process. If the student records system does not have a transfer module, and the institution has a large number of transfer students, the lack of this module will limit the functionality of the system for a considerable part of the student population.

- Develop a reasonable, but comprehensive implementation plan prior to purchase of the system. Within the plan, set realistic expectations about which programs and students to bring into the system first. Identify and outline political responsibilities for the project at the outset. Maintain the integrity of this plan as well as possible.

- Investigate the system maintenance requirements and identify the resources which will be able to provide on-going support to the project. Rules for degree programs may require yearly updating. New versions of the software may become available with functions that are desired for use. Maintenance contracts may be offered for a fee, but an on-going financial commitment from the institution may be not available.

- If the implementation is under-taken centrally, still make every effort to involve the academic units in the implementation process. Essentially, personnel in the units will become end-users of the reports generated by the advising system. Representatives from the colleges, schools and departments should be invited to orientation and training sessions and should be involved in the process of verifying the accuracy of the reports. Several institutions have developed user implementation groups consisting of the administrative and technical coordinators and one representative from each of the academic units designated for using the system.

- Develop an institutional network of support for the project. Assist supervisory personnel in gaining an appreciation of the complexity and usefulness of this system. Strive to keep the implementation effort, and eventually, maintenance of the system, an institutional priority.

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T4-2
Automating the Federal Verification Process

Robert Hahn
University of Akron

Automating the Federal Verification Process

Robert Hahn
Director, Student Financial Aid
University of Akron

Concern for the accuracy of data submitted to support applications for financial assistance has caused the Department of Education to institute an organized program of "verification". In this program, the applications of certain students are selected on the basis of an "error-prone profile" likely to be reported incorrectly. Postsecondary educational institutions which award aid to students selected by the verification edits are required to collect additional documentation of the financial circumstances of the student, and if the student is dependent, of the parents. Institutions are also urged, although not strictly required, to collect documentation of the conditions which make a student independent of support from his/her parents.

The kinds of documentation which must be obtained vary depending upon the characteristics of the student and family. For example, a student who has been selected for verification and is dependent on his/her parents, must obtain a copy of the parents' federal income tax form 1040, 1040A, or 1040EZ, unless:

- the parents are not tax filers, in which case a certificate of non-filing status must be obtained;
- one of the parents is a dislocated worker, in which case a certification from the cognizant state or local agency must be obtained; or
- the parents are married but filed separate tax returns, in which case both tax returns must be obtained.

Once the documentation has been received, the actions that must be taken are equally complex. If the student has received a Pell Grant, the dollar value of a number of data elements may not differ from the original submission by more than $200. If, however, the student does not receive a Pell Grant, the abovementioned data elements may differ by as much as $800. If changes do need to be made, the institution must then recalculate ability to pay and inform the Department of Education of the changes, unless the recalculation did not cause a change in the Pell Grant award. This cannot be known, of course, until after the recalculation has been done. Implementation of this verification process at the campus level, which involves verifying the data of at least 30 percent of each year's aid applicants, places a substantial burden on the staff of the financial aid office. The process involves, at a minimum:

- Determination of the required documentation that the student needs to submit;

- Requesting and re-requesting documentation from a student until all information is received;

- Comparing the original data with the verification data and determining if differences of significant magnitude exist that would require recomputation;

- Performing the recalculation of ability to pay, possibly repackaging the student, and determining whether changes need to be communicated to the Department of Education;

- Communicating the changes; and

- Obtaining a new Student Aid Report (SAR) reflecting the changes.

In a manual operation, many of these actions require decisions that can only be made by a member of the professional staff--a resource which is increasingly scarce at many colleges and universities. Fortunately, however, the process is amenable to automation. The College Scholarship Service (CSS), for more than 15 years a provider of software solutions for financial aid administration, has developed the AUDITOR system to automate the verification process. The balance of this paper describes how the University of Akron, a beta test site for AUDITOR, implemented the system and the benefits that the University has realized.

The University of Akron is a large urban public university with over 29,000 students. During 1990-91, the University of Akron received over 18,000 need analysis documents. Over 98 percent of the documents were Financial Aid Forms (FAF) from the College Scholarship Service. The FAF also serves as the financial aid application.

Automating the verification process was important to the University of Akron because the financial aid office had not added staff since 1983, and applicant volume had increased by over 50 percent. Since the verification process was a substantially new responsibility that had to be undertaken without additional staff, it was necessary to automate this process through the use of systems.

The University of Akron's mainframe financial aid system was developed in-house, with the first version on-line in 1977-78. There was a partial redesign in 1982-83. The University effectively used CSS software packages in that redesign. The CSS software called PARS, the Packaging Aid Resources System, INAS, the Institutional Need Analysis System, and most recently AUDITOR, were incorporated into the University's system.

AUDITOR is a rule-based system which has CSS-defined parameters that comply with federal verification procedures. An example of the AUDITOR rule is shown in Exhibit 1. One of the real advantages of AUDITOR is the ease with which the CSS rules can be modified, expanded, or contracted to conform to local plans and procedures.

The AUDITOR rules perform comparisons of data from various sources to determine what documentation the student needs to submit to complete the verification of the previously submitted need analysis data. AUDITOR is designed to use these verification rules in a step-wise fashion to complete the verification process. In other words, AUDITOR will analyze a student's need analysis data in regards to the first verification rule to determine if that rule has been broken. If that rule has been broken, a request is sent to the student to supply the needed information. When the student responds to this request, the information provided is entered into AUDITOR and the student then continues through the verification process. If additional information is needed to complete the process, the program will then send a second verification letter, and so on, until the student's data is completely verified.

The University of Akron has chosen to modify AUDITOR's verification approach from a step-wise approach to a continuous verification approach. For example, when a student's need analysis information is sent to AUDITOR, all of the required documentation is ascertained by the program and then requested on a single verification letter. The change from a step-wise verification process to a continuous verification process was accomplished by changing selected AUDITOR rules from being "Fatal" errors (errors that cause an exit from the verification process) to "Non-Fatal" errors, which allow a student to continue through the verification process. This was accomplished through simple changes to parameter statements.

Before AUDITOR was implemented, the University of Akron received the processed FAFs from CSS in both electronic and paper format. The paper FAF and Financial Aid Form Need Analysis Report (FAFNAR) were then reviewed manually to determine whether the student had been selected for verification. If a student had been selected, one of the need analysis personnel would determine the appropriate documentation that a student needed to submit from the data on the forms. The staff person would then manually prepare a "check box" letter and mail it to the student. If the first letter did not produce a complete response from the student, a second letter would be prepared after three weeks. Not only did this require considerable staff time in preparing the letters, the process of monitoring individual student responses was time-consuming and error-prone.

Once the student had returned the required documentation, need analysis personnel would then check to ensure that all of the appropriate information had been submitted. The verified data would be noted manually on the FAFNAR, and the corrected data would be entered into the financial aid processing system through on-line key entry. Another CSS software system, INAS, the Institutional Need Analysis System, would be invoked to generate a new FAFNAR reflecting the corrected data.

After AUDITOR was installed, the verification process radically changed. Since AUDITOR interacts with INAS, there was no longer any need to receive the paper FAFNAR in the financial aid office. When a student completes the FAF, CSS processes the student's record and electronically sends the information to the University through Rapid Electronic Data Delivery (REDDy). This is entered directly into the financial aid processing system. AUDITOR is invoked to determine all documentation that the student needs to submit in order to complete verification.

AUDITOR includes a letter generation capability, with the text under the control of the university. The University of Akron uses that capacity to produce the letters to students automatically. AUDITOR also has the capability to generate routine follow-up letters on a schedule determined by the university. Naturally, this capability has reduced substantially the clerical activity required simply to obtain the required documentation. Akron has also designed an on-line screen display to show the documentation that has been requested.

When the documentation is received, it is reviewed against the on-screen display to ensure that all the required information has been submitted. The information is then entered into the system on-line, INAS is invoked, and the recomputed information is displayed on screen. Rosters of the variances, as displayed in Exhibit 2, can be produced if necessary.

Each year, the University of Akron receives over 18,000 FAFs from students. In the old manual verification environment, the process was continual and not completed until all applicants selected by the government were verified. In Akron's new AUDITOR automated verification environment, the process can be completed much more rapidly. In 1991, Akron began verification using AUDITOR in February and had verified more than 9,000 FAFs by May. Verification was then complete, because well over the required 30 percent of applicants had been verified. It also assured that substantially all of the campus-based aid recipients had been verified. This greatly enhanced the ability to deliver the right aid to the right students in the right amounts.

Equally important to the University, automation of the verification process using AUDITOR made it possible to change the composition of the staff required to perform verification. Under the old, manual process, one member of the professional staff and at least two members of the regular clerical staff were assigned to the process for six months. Under the new automated system, only one member of the clerical staff was assigned to the process, and student employees were used to perform the data entry. This has freed valuable staff resources for other activities, such as loan processing.

The final part of the verification process is to communicate changed financial data to the Pell Grant processor. The Department of Education has implemented an Electronic Data Exchange (EDE) system that permits the University to communicate those changes electronically. In the past, the University used a PC-based system to participate in EDE. The PC-based system required additional manual data entry by the staff. The University discontinued its use this past year and asked students to inform the Pell Grant processor of data corrections. For the 1992-93 processing year, AUDITOR will provide an automatic link to communicate the changes directly without any intervention on the part of the staff or the students.

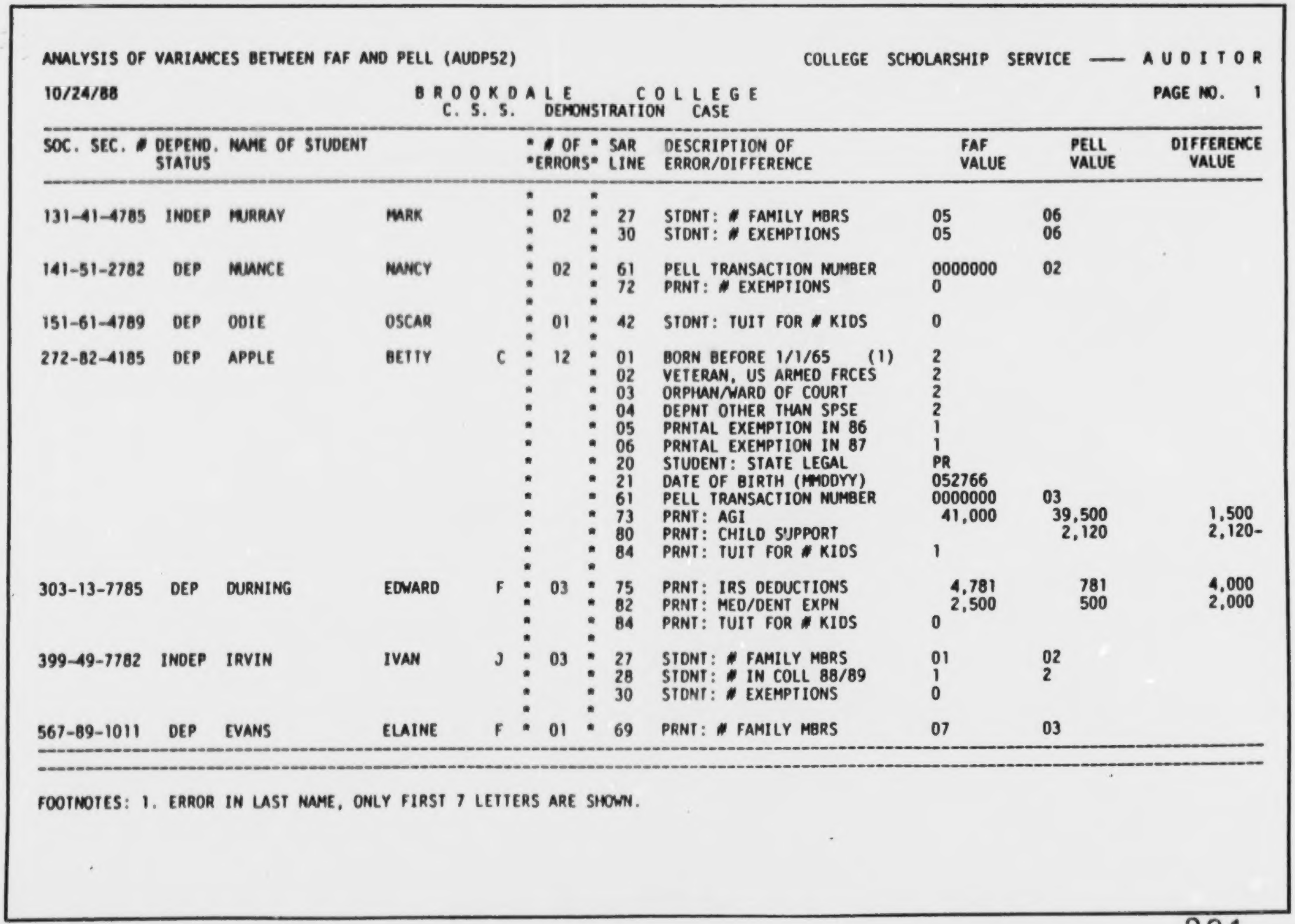
In 1992-93, the University of Akron will use some of the staff resources freed by AUDITOR to develop a mainframe-to-mainframe loan processing system which will eliminate the receipt of over 90 percent of the more than 6,000 guaranteed student loan applications processed each year. For that system to work, however, need analysis and verification must continue to be completed efficiently and on a timely basis. AUDITOR, of course, is the peg or linchpin to making all of this fall into place. There is no question that AUDITOR has made a significant contribution to timely and efficient verification processing at the University of Akron.

EXHIBIT 1

RULE NUMBER	GROUP	SELECTION:	FAF DATA FIELD:	COMPARED TO: RECORD FIELD	TOLERANCE:	ACTION IF RULE IS BROKEN:
20	-	Any student breaking first 19 rules			Fatal	Request any documents associated with prior rules
25	1	Dependent Pell recipient*#@	Parents' AGI (24)	P-1040 AGI	$200	Replace Recalculate Generate Pell letter line 87
26	1	Dependent Pell recipient*#@	Student's AGI (24)	S-1040 AGI	$200	Replace Recalculate Generate Pell letter line 38
27	3	Independent Pell recipient*#@	Student's AGI (24)	S-1040 AGI	$200	Replace Recalculate Generate Pell letter line 38
28	2	Dependent or independent campus-based or GSL recipient*#	Student's AGI (24)	S-1040 AGI	$800	Replace Recalculate
29	2	Dependent campus-based or GSL recipient*#	Parents' AGI (24)	P-1040 AGI	$800	Replace Recalculate
30	1	Dependent Pell recipient*#@	Parents' Federal tax paid (25)	P-1040 Tax Paid	$200	Replace* Recalculate Generate Pell letter line 88
31	-	Dependent Pell recipient*#@	Student's Federal tax paid (25)	S-1040 Tax Paid	$200	Replace Recalculate Generate Pell letter line 39
32	3	Independent Pell recipient*#@	Student's Federal tax paid (25)	S-1040 Tax Paid	$200	Replace Recalculate Generate Pell letter line 39
33	2	Dependent or independent campus based or GSL recipient*#	Student's Federal tax paid (25)	S-1040 Tax Paid	$800	Replace Recalculate
34	2	Dependent campus-based or GSL recipient*#	Parents' Federal tax paid (25)	P-1040 Tax Paid	$800	Replace Recalculate

* Only if tax return has been or will be filed
# Only if analysis type is not dislocated worker
@ Only if not special condition

EXHIBIT 2



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ANALYSIS OF VARIANCES BETWEEN FAF AND PELL (AUDP52)                          COLLEGE SCHOLARSHIP SERVICE ---- A U D I T O R
10/24/88                                B R O O K D A L E     C O L L E G E                                        PAGE NO.  1
                                          C. S. S.  DEMONSTRATION   CASE
-------------------------------------------------------------------------------------------------------------------------------
SOC. SEC. # DEPEND. NAME OF STUDENT                   * # OF * SAR  DESCRIPTION OF                  FAF        PELL     DIFFERENCE
            STATUS                                    *ERRORS* LINE ERROR/DIFFERENCE               VALUE      VALUE       VALUE
-------------------------------------------------------------------------------------------------------------------------------
                                                      *        *
131-41-4785  INDEP  MURRAY         MARK               *  02    *  27  STDNT: # FAMILY MBRS        05         06
                                                      *        *  30  STDNT: # EXEMPTIONS         05         06
                                                      *        *
141-51-2782   DEP   MUANCE         NANCY              *  02    *  61  PELL TRANSACTION NUMBER     0000000    02
                                                      *        *  72  PRNT: # EXEMPTIONS          0
                                                      *        *
151-61-4789   DEP   ODIE           OSCAR              *  01    *  42  STDNT: TUIT FOR # KIDS      0
                                                      *        *
272-82-4185   DEP   APPLE          BETTY          C   *  12    *  01  BORN BEFORE 1/1/65    (1)  2
                                                      *        *  02  VETERAN, US ARMED FRCES     2
                                                      *        *  03  ORPHAN/WARD OF COURT        2
                                                      *        *  04  DEPNT OTHER THAN SPSE       2
                                                      *        *  05  PRNTAL EXEMPTION IN 86      1
                                                      *        *  06  PRNTAL EXEMPTION IN 87      1
                                                      *        *  20  STUDENT: STATE LEGAL        PR
                                                      *        *  21  DATE OF BIRTH (MMDDYY)      052766
                                                      *        *  61  PELL TRANSACTION NUMBER     0000000    03
                                                      *        *  73  PRNT: AGI                    41,000    39,500       1,500
                                                      *        *  80  PRNT: CHILD SUPPORT                     2,120       2,120-
                                                      *        *  84  PRNT: TUIT FOR # KIDS       1
                                                      *        *
303-13-7785   DEP   DURNING        EDWARD         F   *  03    *  75  PRNT: IRS DEDUCTIONS         4,781       781       4,000
                                                      *        *  82  PRNT: MED/DENT EXPN          2,500       500       2,000
                                                      *        *  84  PRNT: TUIT FOR # KIDS       0
                                                      *        *
399-49-7782  INDEP  IRVIN          IVAN           J   *  03    *  27  STDNT: # FAMILY MBRS        01         02
                                                      *        *  28  STDNT: # IN COLL 88/89      1          2
                                                      *        *  30  STDNT: # EXEMPTIONS         0
                                                      *        *
567-89-1011   DEP   EVANS          ELAINE         F   *  01    *  69  PRNT: # FAMILY MBRS         07         03
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FOOTNOTES: 1. ERROR IN LAST NAME, ONLY FIRST 7 LETTERS ARE SHOWN.
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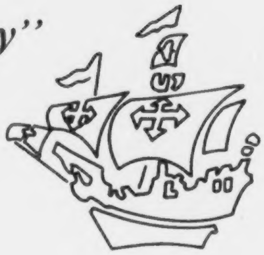


T4-3

Electronic Transcript Processing — FASTER Into the Future

Kathryn Davies
University of Florida

ELECTRONIC TRANSCRIPT PROCESSING ......
F.A.S.T.E.R. INTO THE FUTURE

Kathryn Davies
Computer Programmer Analyst Manager
University of Florida

INTRODUCTION

BUDGET, BUDGET, BUDGET..... Stay within the budget. How often does this subject come up? Every day, every week, every year? Here at the Office of the University Registrar (O.U.R.) at the University of Florida, we are always looking for solutions to save time and money. The transfer and receipt of electronic transcripts have become tremendous time and money savers. Hopefully, as we move toward the future when more institutions send us electronic transcripts, our process will become even more automated, allowing us to spend more time on other projects and new developments.

THE UNIVERSITY OF FLORIDA ENVIRONMENT

Situated in the heart of north central Florida in Gainesville, the University of Florida (UF), Florida's oldest university, was founded in 1853. The East Florida Seminary, located in Ocala, was consolidated with the land-grant Florida Agriculture College in Gainesville to become the University of Florida in 1906. Since then, the University has matured into one of the nation's truly distinctive universities, offering one of the most comprehensive academic programs in the nation. Only two other universities in the country offer more programs on a single campus. The University encompasses sixteen colleges and schools which offer 114 undergraduate majors, 123 master's programs, 76 doctoral programs, and the professional schools of Dentistry, Law, Medicine and Veterinary Medicine.

The more than 34,000 students who attend the University each year come from every county in the state, every state in the union, and over 100 foreign countries. Admission to UF is competitive in all fields of study; therefore, the University must subscribe to a policy of selective admission. For a given entering term, the number of applicants far exceeds the number of spaces available. Approximately 14,000 freshman, 7800 transfer, and 12,500 graduate/professional applications to UF are received each year. From these applications, UF receives over 40,000 student transcripts each year. With this volume, electronic transcripts play a major role in admission processing. The electronic receipt of all transcripts is a goal UF hopes to acheive.

O.U.R. PROCESSING OF PAPER TRANSCRIPTS

PAPER, PAPER, PAPER..... Who wants it! At this time, UF needs it because paper copy transcripts are required for students who attend an institution that does not send transcripts electronically. The following paragraphs describe the procedure UF follows to process a student's application when a paper copy transcript is received. The first section describes the process for a high school (secondary) applicant requesting admission to UF and the second section describes the process for a college or community college (postsecondary) transfer applicant requesting UF admission.

The high school student fills out an admissions application and asks the high school to send a copy of the high school transcript to UF. Since this high school does not send transcripts electronically, UF receives a paper copy transcript. A few days later the application and transcript arrive at UF's Office of Admissions mailroom. The mailroom sends both items to an admissions clerk who applies the student's admission information to the Admissions Application screen and updates the screen to reflect the date of receipt of the transcript.

The student's transcript and application are put in a mail sorter bin in alphabetical order by the date of receipt and sent to Admissions for processing. A nightly computer batch processing job produces a list of applications received the previous day for review and admission decision. A clerk then takes the student's name from this list, matches it up with the paper copy transcript and the student's application folder, and places it for review on an admissions officer's desk. The admissions officer then computes the student's grade point average (GPA), looks at each course the student has taken to see if it meets the minimum course requirements established by the Florida Board of Regents, and updates this information on the Admissions Application screen. A student with an academic unit deficiency is automatically denied admission until all requirements are met.

Another computer batch processing job updates the student's status (acceptance or denial), depending on the student's GPA and test scores. A status letter is then generated and placed in the student's folder to be doubled-checked by the admissions officer and then mailed to the student. Ultimately, the folders with the application and paper copy transcript are sent to the records department where they are stored on microfiche for one year.

The procedure is slightly different for postsecondary institution transfers. If the institution does not send electronic transcripts, a paper copy transcript and the application are mailed to UF. Once the mailroom has received the application and transcript, most of the same processing for a high school application and transcript is followed, with the exception that the paper copy transcript is copied and sent with a referral form to the student's upper division college. The referral is then evaluated by that college and returned to the Office of Admissions with a decision of admission or denial.

If admitted, the transcript is logged in and sent to the transcript section for coding common term dates, prefixes for non-common course numbering schools, courses meeting computation and communication guidelines, lower level vocational courses, and repeated courses. The entire transcript is entered on the Transcript Evaluation screen by a second person, and then a third person checks for accuracy and rolls the transcript to the Student Transcript screen.

After reviewing the paper copy transcript process, it is apparent that this type of transcript processing requires a great deal of time, and the potential for human error is great. It is also possible that a transcript might get lost in the mail or on an employee's desk. Another disadvantage is the time required to mail a transcript. An electronic transcript can be received within one day whereas the mail might not deliver a paper copy transcript for several days. There is also the chance that the secondary or postsecondary institution might neglect to send the transcript.

O.U.R. PROCESSING OF ELECTRONIC TRANSCRIPTS

ELECTRONIC, ELECTRONIC, ELECTRONIC...... Electronic processing of student records is wonderful, for it frees up valuable office time for other activities. The FASTER (Florida Automated System for Transferring Education Records) System, designed in Fall 1987 and implemented in Spring 1988 by the Florida Department of Education, forms the backbone of electronic transcript processing in the State of Florida. This system was developed to provide electronic transfer of student records between school districts, community colleges and universities. It is an electronic mail system; an institution can send a request for an electronic transcript and the requested institution responds by sending an electronic transcript to that institution. Students may request that electronic transcripts be sent to an institution without the institution ever actually requesting a transcript.

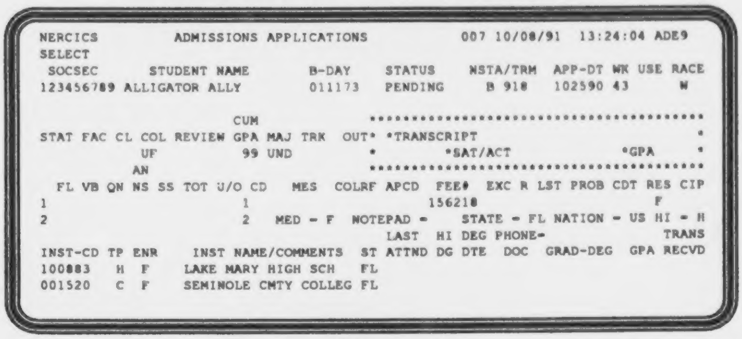
UF admissions applications now contain a clause certifying that when a student signs an application, he or she has given UF permission to request a transcript from the institutions the student has attended. An inter-institutional request speeds up the electronic admissions process and relieves the student of a tedious admission requirement.

Requests and responses both must follow pre-defined record formats and edit specifications as supplied by FIRN (Florida Information Resource Network), which provides the communications network over which requests and response messages travel. UF joined the pilot stages of the electronic transcript processing in 1988 and began sending and receiving production transcripts in August 1989. At the present time, O.U.R. demand has found UFAST

(University of Florida Automated System for Transcripts) processing most effective when running three nights a week.

Today, beginning freshmen who fill out a UF application and sign their name, but who forget to have a transcript sent to UF have actually authorized UF to request the transcript electronically when they signed their application. Once UF receives the application, the mailroom will send it to Admissions for entry on the Admissions Application screen (figure 1). The clerk entering the application will update the application screen with an "F" in the "needs transcript" field along with the name and FICE (Federal Interagency Committee on Education) identification number of the institution. Interactively, the system will go out and pull off the district and school number from our FICE file and post a request for an electronic transcript on the Secondary Transcript Send screen (figure 2).

ADMISSIONS APPLICATION

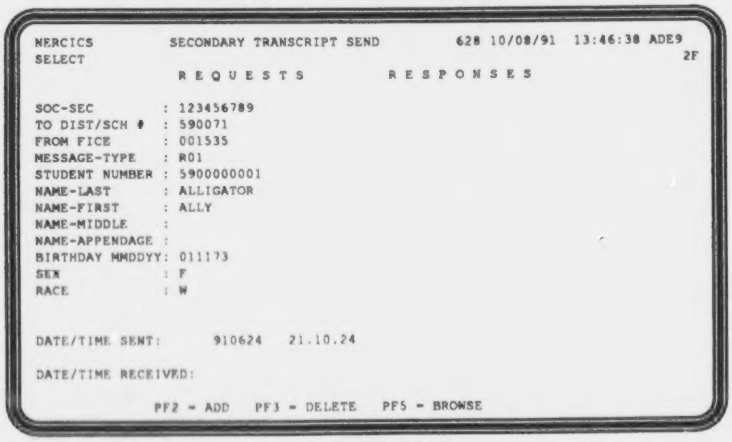


```
NERCICS         ADMISSIONS APPLICATIONS            007 10/08/91  13:24:04 ADE9
SELECT
 SOCSEC      STUDENT NAME       B-DAY    STATUS    NSTA/TRM  APP-DT WK USE RACE
123456789 ALLIGATOR ALLY        011173   PENDING     B 918   102590 43      W

                       CUM             *****************************************
STAT FAC CL COL REVIEW GPA MAJ TRK  OUT* *TRANSCRIPT                           *
            UF          99 UND         *        *SAT/ACT             *GPA      *
           AN                          *****************************************
  FL VB QN NS SS TOT U/O CD   MES  COLRF APCD  FEE#  EXC R LST PROB CDT RES CIP
1                       1                     156218                     F
2                       2   MED - F  NOTEPAD =    STATE - FL NATION - US HI = H
                                         LAST  HI DEG PHONE=              TRANS
INST-CD TP ENR    INST NAME/COMMENTS  ST ATTND DG DTE  DOC  GRAD-DEG  GPA RECVD
100883   H  F    LAKE MARY HIGH SCH   FL
001520   C  F    SEMINOLE CMTY COLLEG FL
```

Figure 1

SECONDARY TRANSCRIPT SEND



```
NERCICS         SECONDARY TRANSCRIPT SEND             628 10/08/91  13:46:38 ADE9
SELECT                                                                        2F
                 R E Q U E S T S           R E S P O N S E S

SOC-SEC        : 123456789
TO DIST/SCH #  : 590071
FROM FICE      : 001535
MESSAGE-TYPE   : R01
STUDENT NUMBER : 5900000001
NAME-LAST      : ALLIGATOR
NAME-FIRST     : ALLY
NAME-MIDDLE    :
NAME-APPENDAGE :
BIRTHDAY MMDDYY: 011173
SEX            : F
RACE           : W


DATE/TIME SENT:       910624   21.10.24

DATE/TIME RECEIVED:

              PF2 - ADD   PF3 - DELETE   PF5 - BROWSE
```

Figure 2

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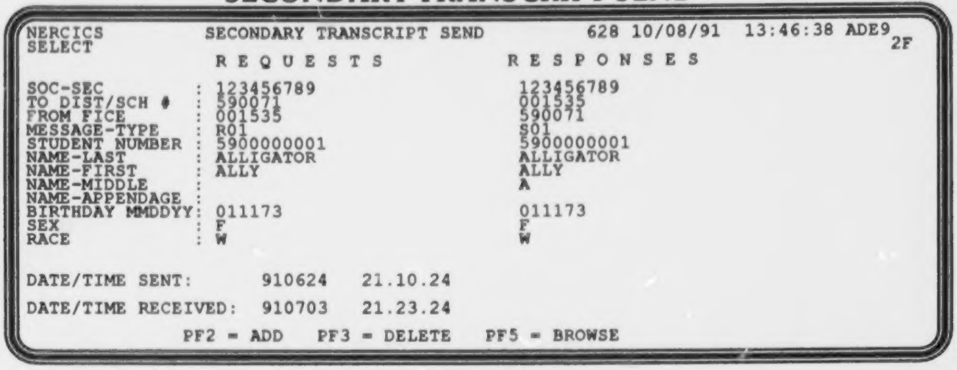
That night, UFAST will run, retrieve and format the transcript request, and send the request to FIRN's mailbox. The institution addressed will pick up the transcript request and send UF a response. UFAST receives the electronic transcript and updates the Secondary Transcript Send screen (figure 3) with the response type and date. There are various response types that can be sent with the electronic transcripts to let UF know whether the transcript actually can be sent electronically. There are also various request types that a requestor can send with a request; for example, a requestor can send a message asking for a paper copy transcript to be sent with the electronic transcript or ask for the electronic transcript to be sent at the end of the current term after grades have been posted. The same UFAST computer program that updates the Secondary Transcript Send screen will apply the transcript to the HS Transcript Records screen (figure 4) and update the Admissions Application screen with the receipt of the electronic transcript. This screen contains all of the necessary information UF needs from the electronic transcript to process the student's application.

SECONDARY TRANSCRIPT SEND



```
NERCICS          SECONDARY TRANSCRIPT SEND        628 10/08/91  13:46:38 ADE9
SELECT                                                                      2F
                  R E Q U E S T S            R E S P O N S E S

SOC-SEC           : 123456789                  123456789
TO DIST/SCH #     : 590071                     001535
FROM FICE         : 001535                     590071
MESSAGE-TYPE      : R01                        S01
STUDENT NUMBER    : 5900000001                 5900000001
NAME-LAST         : ALLIGATOR                  ALLIGATOR
NAME-FIRST        : ALLY                       ALLY
NAME-MIDDLE       :                            A
NAME-APPENDAGE    :
BIRTHDAY MMDDYY   : 011173                     011173
SEX               : F                          F
RACE              : W                          W

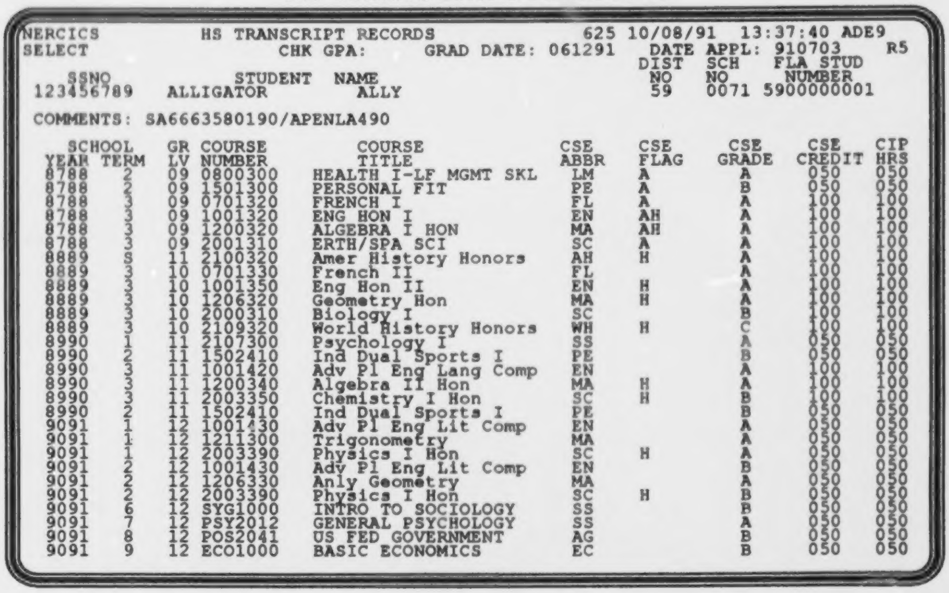
DATE/TIME SENT:        910624   21.10.24

DATE/TIME RECEIVED:    910703   21.23.24

             PF2 = ADD    PF3 = DELETE    PF5 = BROWSE
```

Figure 3

HS TRANSCRIPT RECORDS



```
NERCICS          HS TRANSCRIPT RECORDS            625 10/08/91  13:37:40 ADE9
SELECT                  CHK GPA:      GRAD DATE: 061291   DATE APPL: 910703    R5
                                                          DIST  SCH   FLA STUD
    SSNO             STUDENT  NAME                         NO   NO     NUMBER
 123456789   ALLIGATOR         ALLY                        59   0071 5900000001

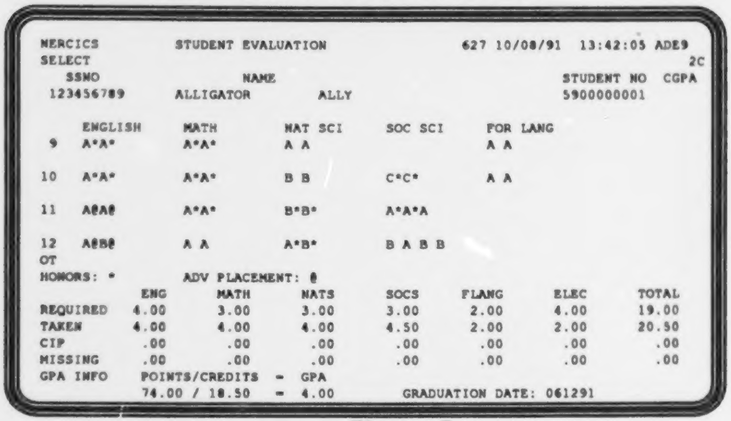
 COMMENTS: SA6663580190/APENLA490

   SCHOOL    GR COURSE         COURSE           CSE    CSE     CSE    CSE    CIP
 YEAR TERM   LV NUMBER         TITLE            ABBR   FLAG    GRADE  CREDIT HRS
 8788   2    09 0800300  HEALTH I-LF MGMT SKL    LM    A        A     050    050
 8788   2    09 1501300  PERSONAL FIT            PE    A        B     050    050
 8788   3    09 0701320  FRENCH I                FL    A        A     100    100
 8788   3    09 1001320  ENG HON I               EN    AH       A     100    100
 8788   3    09 1200320  ALGEBRA I HON           MA    AH       A     100    100
 8788   3    09 2001310  ERTH/SPA SCI            SC    A        A     100    100
 8889   S    11 2100320  Amer History Honors     AH    H        A     100    100
 8889   3    10 0701330  French II               FL             A     100    100
 8889   3    10 1001350  Eng Hon II              EN    H        A     100    100
 8889   3    10 1206320  Geometry Hon            MA    H        A     100    100
 8889   3    10 2000310  Biology I               SC             B     100    100
 8889   3    10 2109320  World History Honors    WH    H        C     100    100
 8990   1    11 2107300  Psychology I            SS             A     050    050
 8990   2    11 1502410  Ind Dual Sports I       PE             B     050    050
 8990   3    11 1001420  Adv Pl Eng Lang Comp    EN             A     100    100
 8990   3    11 1200340  Algebra II Hon          MA    H        A     100    100
 8990   3    11 2003350  Chemistry I Hon         SC    H        B     100    100
 8990   2    11 1502410  Ind Dual Sports I       PE             B     050    050
 9091   1    12 1001430  Adv Pl Eng Lit Comp     EN             A     050    050
 9091   1    12 1211300  Trigonometry            MA             A     050    050
 9091   1    12 2003390  Physics I Hon           SC    H        A     050    050
 9091   2    12 1001430  Adv Pl Eng Lit Comp     EN             B     050    050
 9091   2    12 1206330  Anly Geometry           MA             A     050    050
 9091   2    12 2003390  Physics I Hon           SC    H        B     050    050
 9091   6    12 SYG1000  INTRO TO SOCIOLOGY      SS             B     050    050
 9091   7    12 PSY2012  GENERAL PSYCHOLOGY      SS             A     050    050
 9091   8    12 POS2041  US FED GOVERNMENT       AG             B     050    050
 9091   9    12 ECO1000  BASIC ECONOMICS         EC             B     050    050
```

Figure 4

Next, UFAST will compute the student's GPA and calculate the number of academic units. UFAST updates the Student Evaluation screen (figure 5) and displays this information in an easy format for the admissions officers to use. If the student is not missing any course units, the student's GPA will roll to the Admissions Application screen (figure 6). If the student information on the Admissions Application screen displays that the student has all necessary materials (transcripts, GPA and test scores), then an admissions decision will be made. A letter is generated and matched to the student's folder. An admissions officer will double-check the student's admission status before mailing the status letter.

STUDENT EVALUATION



```
NERCICS          STUDENT EVALUATION              627 10/08/91  13:42:05 ADE9
SELECT                                                                     2C
  SSNO                     NAME                          STUDENT NO  CGPA
 123456789       ALLIGATOR        ALLY                   5900000001

     ENGLISH       MATH          NAT SCI       SOC SCI       FOR LANG
  9  A*A*          A*A*          A A                         A A

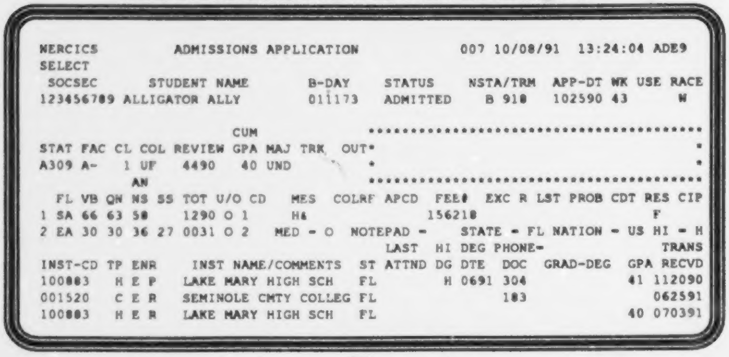
 10  A*A*          A*A*          B B           C*C*          A A

 11  A@A@          A*A*          B*B*          A*A*A

 12  A@B@          A A           A*B*          B A B B
OT
HONORS: *          ADV PLACEMENT: @
              ENG        MATH        NATS       SOCS       FLANG      ELEC       TOTAL
REQUIRED     4.00        3.00        3.00       3.00        2.00       4.00      19.00
TAKEN        4.00        4.00        4.00       4.50        2.00       2.00      20.50
CIP           .00         .00         .00        .00         .00        .00        .00
MISSING       .00         .00         .00        .00         .00        .00        .00
GPA INFO     POINTS/CREDITS  -  GPA
             74.00 / 18.50   -  4.00        GRADUATION DATE: 061291
```

Figure 5

ADMISSIONS APPLICATION



```
NERCICS         ADMISSIONS APPLICATION           007 10/08/91  13:24:04 ADE9
SELECT
 SOCSEC       STUDENT NAME        B-DAY    STATUS    NSTA/TRM  APP-DT WK USE RACE
123456789 ALLIGATOR ALLY          011173   ADMITTED    B 918   102590 43       W

                     CUM                ****************************************
STAT FAC CL COL REVIEW GPA MAJ TRK  OUT*                                       *
A309 A-   1 UF   4490   40 UND         *                                       *
           AN                           ****************************************
  FL VB QN NS SS TOT U/O CD    MES   COLRF APCD  FEE#  EXC R LST PROB CDT RES CIP
1 SA 66 63 58     1290 O 1     H6                156218                     F
2 EA 30 30 36 27 0031 O 2   MED - O  NOTEPAD -    STATE - FL NATION - US HI - H
                                          LAST  HI DEG PHONE-                 TRANS
INST-CD TP ENR    INST NAME/COMMENTS  ST ATTND DG DTE  DOC  GRAD-DEG  GPA RECVD
100803   H E P   LAKE MARY HIGH SCH   FL          H 0691 304              41 112090
001520   C E R   SEMINOLE CMTY COLLEG FL                 183                 062591
100803   H E R   LAKE MARY HIGH SCH   FL                                  40 070391
```

Figure 6

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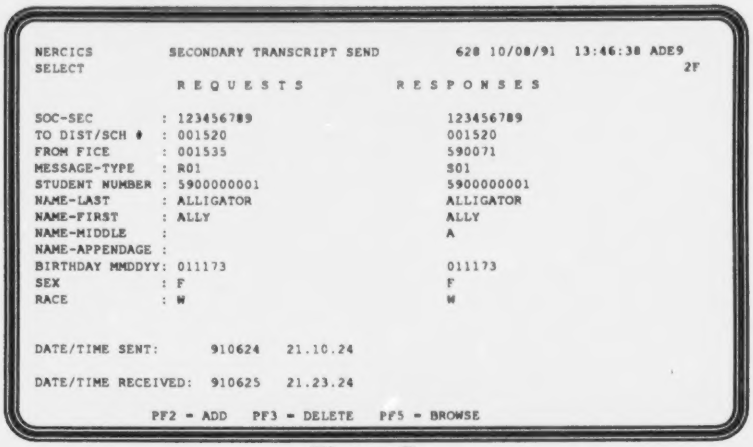
Frequently, high school students enroll in college courses; these college credits can be applied to their admission status and they may also satisfy college-level requirements. If the credits taken were from a postsecondary institution sending transcripts electronically, the institution will send an electronic transcript by request from UF or the student. UFAST will pick up the electronic transcript from the mailbox and update the Admissions Application screen (figure 6) and the Postsec Transcript Sender screen (figure 7) with receipt of the transcript. At the same time, UFAST will apply the transcript to the Electronic Transcript screen (figure 8) which interactively calculates hours earned, grade points and GPA. Admissions will receive notification of receipt of an electronic transcript from a "received" list. They will then code the Admissions Application screen (figure 6) with the GPA, and if all of the necessary materials are in, an admissions decision will be made.

POSTSEC TRANSCRIPT SENDER



```
NERCICS        SECONDARY TRANSCRIPT SEND        628 10/08/91  13:46:38 ADE9
SELECT                                                                  2F
               R E Q U E S T S          R E S P O N S E S

SOC-SEC        : 123456789                       123456789
TO DIST/SCH #  : 001520                          001520
FROM FICE      : 001535                          590071
MESSAGE-TYPE   : R01                             S01
STUDENT NUMBER : 5900000001                      5900000001
NAME-LAST      : ALLIGATOR                       ALLIGATOR
NAME-FIRST     : ALLY                            ALLY
NAME-MIDDLE    :                                 A
NAME-APPENDAGE :
BIRTHDAY MMDDYY: 011173                          011173
SEX            : F                               F
RACE           : W                               W

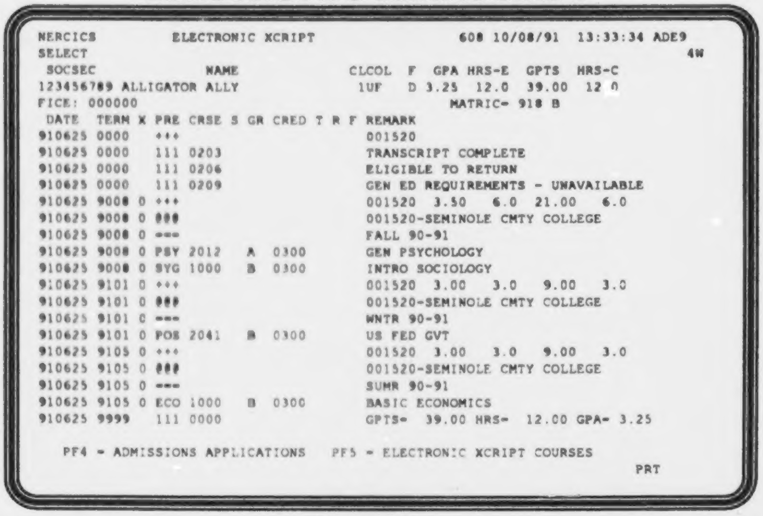

DATE/TIME SENT:      910624   21.10.24

DATE/TIME RECEIVED:  910625   21.23.24

            PF2 - ADD   PF3 - DELETE   PF5 - BROWSE
```

Figure 7

ELECTRONIC TRANSCRIPT



```
NERCICS        ELECTRONIC XCRIPT                 608 10/08/91  13:33:34 ADE9
SELECT                                                                   4W
 SOCSEC             NAME               CLCOL  F  GPA HRS-E  GPTS  HRS-C
123456789 ALLIGATOR ALLY                1UF   D 3.25  12.0  39.00  12.0
FICE: 000000                                     MATRIC- 918 B
 DATE  TERM X PRE CRSE S GR CRED T R F REMARK
910625 0000   +++                       001520
910625 0000   111 0203                  TRANSCRIPT COMPLETE
910625 0000   111 0206                  ELIGIBLE TO RETURN
910625 0000   111 0209                  GEN ED REQUIREMENTS - UNAVAILABLE
910625 9008 0 +++                       001520  3.50   6.0  21.00   6.0
910625 9008 0 ###                       001520-SEMINOLE CMTY COLLEGE
910625 9008 0 ===                       FALL 90-91
910625 9008 0 PSY 2012   A  0300        GEN PSYCHOLOGY
910625 9008 0 SYG 1000   B  0300        INTRO SOCIOLOGY
910625 9101 0 +++                       001520  3.00   3.0   9.00   3.0
910625 9101 0 ###                       001520-SEMINOLE CMTY COLLEGE
910625 9101 0 ===                       WNTR 90-91
910625 9101 0 POS 2041   B  0300        US FED GVT
910625 9105 0 +++                       001520  3.00   3.0   9.00   3.0
910625 9105 0 ###                       001520-SEMINOLE CMTY COLLEGE
910625 9105 0 ===                       SUMR 90-91
910625 9105 0 ECO 1000   B  0300        BASIC ECONOMICS
910625 9999   111 0000                  GPTS-  39.00 HRS-  12.00 GPA- 3.25

   PF4 - ADMISSIONS APPLICATIONS   PF5 - ELECTRONIC XCRIPT COURSES
                                                                 PRT
```

Figure 8

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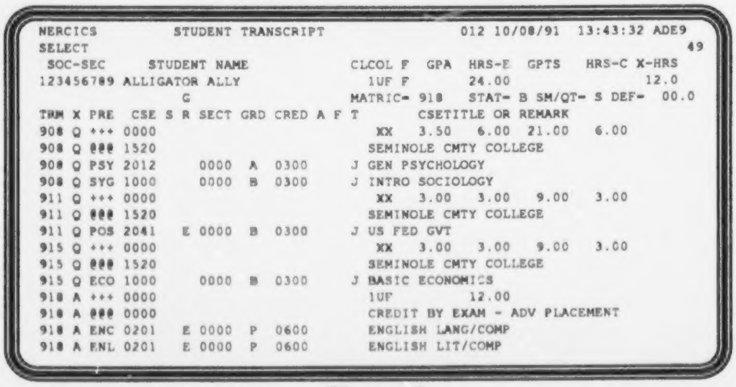
Electronic transcripts received for a transfer student from a postsecondary institution are processed in basically the same manner as high school transcripts for beginning freshmen, as outlined previously. However, admissions decisions for transfer students are made at the upper division college to which the student has applied. An admissions computer program will generate a referral to be sent to the college along with the student's transcript. Since the transcript is sent electronically, a college administrator can review the transcript on the Electronic Transcript screen and make a decision. The electronic transcript eliminates the need for a paper copy transcript to be sent with the referral.

If there is an admitted status, someone from the transcript processing office will review the electronic transcript on-line, make changes where necessary, and roll the transcript to the Student Transcript screen (figure 9). Upon matriculation, the electronic transcript becomes the permanent UF record.

STUDENT TRANSCRIPT



```
NERCICS        STUDENT TRANSCRIPT               012 10/08/91  13:43:32 ADE9
SELECT                                                                  49
 SOC-SEC      STUDENT NAME                CLCOL F  GPA  HRS-E  GPTS   HRS-C X-HRS
123456789 ALLIGATOR ALLY                    1UF F        24.00                12.0
               G                          MATRIC- 918   STAT- B SM/QT- S DEF-  00.0
TRM X PRE  CSE S R SECT GRD CRED A F T        CSETITLE OR REMARK
908 Q +++ 0000                               XX   3.50   6.00  21.00   6.00
908 Q @@@ 1520                              SEMINOLE CMTY COLLEGE
908 Q PSY 2012     0000  A  0300     J GEN PSYCHOLOGY
908 Q SYG 1000     0000  B  0300     J INTRO SOCIOLOGY
911 Q +++ 0000                               XX   3.00   3.00   9.00   3.00
911 Q @@@ 1520                              SEMINOLE CMTY COLLEGE
911 Q POS 2041   E 0000  B  0300     J US FED GVT
915 Q +++ 0000                               XX   3.00   3.00   9.00   3.00
915 Q @@@ 1520                              SEMINOLE CMTY COLLEGE
915 Q ECO 1000     0000  B  0300     J BASIC ECONOMICS
918 A +++ 0000                              1UF          12.00
918 A @@@ 0000                              CREDIT BY EXAM - ADV PLACEMENT
918 A ENC 0201   E 0000  P  0600            ENGLISH LANG/COMP
918 A ENL 0201   E 0000  P  0600            ENGLISH LIT/COMP
```

Figure 9

UFAST at the secondary level has eliminated several steps formerly needed to process a student's application. Admissions officers must still make an admissions decision for the student; however, they no longer have to compute the student's GPA or missing units. They also have a handy on-line reference available (the Student Evaluation screen, figure 5) to help them reach a decision.

UFAST at the postsecondary level has removed manual coding of the transcript and adding the records to the Transcript Evaluation screen by hand. Most of the postsecondary electronic transcripts have common course numbers, a code for repeated courses, and third-party work from other institutions. Having third-party coursework from another institution speeds up the decision process so that UF can make a decision prior to the receipt of the third-party transcript. The third-party update also notifies UF of additional institutions that the student might not have reported.

F.A.S.T.E.R. ELECTRONIC TRANSCRIPT DESIGN

Electronic transcripts are designed to contain the same information as a paper copy transcript. In most instances, however, an electronic transcript will actually contain more information.

SECONDARY DESIGN

The secondary electronic transcripts are made up of nine different types of records, each containing information about the student.

Type S00:	The request/response header record contains the information (such as student name, social security number, sex, and birthday) needed to process the request. This also records the district and school number to which the request/response is sent; FIRN uses this number to place the request/response in the correct mailbox.
Type S01:	Student Personal Information
Type S02:	Student Immunization Information
Type S03:	Student School Year Information
Type S04:	Student Course Information
Type S05:	Student VOC/LEP/Dropout Information
Type S06:	Exceptional Student Information
Type S07:	Student Comments
Type S08:	Student Test Information

At this time, UF receives SAT and ACT test scores electronically through the SSDC Electronic SAT and ACT Test Score Distribution System.

POSTSECONDARY DESIGN

There are eight different types of records for Postsecondary processing.

Type P00:	The header record for postsecondary requests and responses. This record contains most of the same information required on the secondary header record with one exception; the FICE number of the institution is used to identify the school to FIRN for a transcript request or response.
Type P01:	Transcript Information and Eligibility Status
Type P02:	Term Header Information and Term Dates
Type P03:	Course Information and Grades for Each Course
Type P04:	Term Remarks
Type P05:	Transfer Information
Type P06:	Test Information
Type P07:	Degree Information

O.U.R. HISTORICAL DATA, HIGHLIGHTS AND BENEFITS

Since UFAST was implemented in 1989, UF has received approximately 30,000 transcripts and transmitted 7000 electronic transcripts to other postsecondary institutions. As of November 1991, UF receives electronic transcripts from 12 postsecondary institutions and 13 school districts. These numbers will increase as more institutions and school districts come on-line. The Department of Education has requested that all institutions and school districts be in production by December 1991.

Electronic transcripts have played a significant role at O.U.R. Some advantages include:

** Electronic transcripts are easier to manage than paper copy; there is nothing to handle because the transcript is stored on DASD.
** Electronic transcripts are rarely misplaced.
** Electronic transcripts are faster than the mail, whether sending a request or by receiving one. Also, an electronic transcript can be sent/received in one day and it is rarely lost en route.
** The automated process has tremendously reduced processing hours.
** Administrative functions are more easily performed with electronic transcripts than with paper copy transcripts.

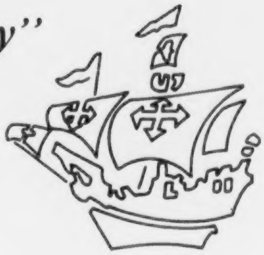
O.U.R. FUTURE OF ELECTRONIC TRANSCRIPTS

FASTER, FASTER, *F.A.S.T.E.R.....* we go towards the future. Electronic transcripts are the way of the future, and the future of electronic transcripts plays an important role at UF. We will continue to bring more school districts, colleges and universities on-line and as we receive more and more electronic transcripts, admissions will become more automated. Each year UF implements new enhancements to UFAST; concurrently, enhancements are being made by the FIRN system.

At this time, UF is involved in a pilot test with the University of Texas through the FIRN network in Tallahassee using SPEEDE (Standardization of Postsecondary Education Electronic Data Exchange), the system for interstate electronic transmission of postsecondary transcripts. These are just the initial developmental steps to transfer transcripts electronically to other states and foreign countries. The University hopes to transfer electronic transcripts to other institutions nationally or internationally in the near future. Who knows, maybe our next pilot testing will be with your institution?

37th Annual College and University
Computer Users Conference

"Discover New Worlds With Technology"



T4-4

Leveraging Your Investment in Older Technology Through Tailored User Interfaces (TUI's)

Thomas Scott
Jack Duwe
Joseph Rossmeissl
University of Wisconsin-Madison

Leveraging Your Investment in Older Technology Through Tailored User Interfaces (TUIs)

Jack Duwe
Director

Thomas J. Scott
Assistant to the Director

Joseph Rossmeissl
Management Information Specialist

Administrative Data Processing
University of Wisconsin-Madison

A fundamental shift is taking place in the nature of "the user" of administrative computing services. New kinds of people are using computers in increasingly powerful ways. They are not "techies" in the conventional sense and are certainly not programmers. They are students, teaching faculty, senior administrators (deans and such), and others who in the past have relied for data processing support on "heads-down" staff — process-oriented workers who spend their days at terminals performing data entry tasks.

The new user is comfortable with technology and is eager to take advantage of microcomputers and the word processing, spreadsheet, and electronic mail tools available on micros.

But along with their skill and energy, new users bring non-traditional expectations that pose a serious challenge to the operators of administrative computing services. New users typically come from the microcomputer world, where applications have different looks and feels. When they see the traditional 3270 teleprocessing interface on an administrative application, they react negatively. For these users, the 3270 interface has essentially become a barrier to effective use of the organization's data resource.

An opportunity and a responsibility

We argue that this should not be seen as a problem for the providers of administrative computing services. Rather, the evolution of the user presents a major opportunity to enhance the use of centralized data and, indeed, leverage the investment in 3270 teleprocessing.

At the University of Wisconsin-Madison, we are taking advantage of this opportunity by revamping the interface to our administrative computing system. By developing "tailored user interfaces" (TUIs) for several mainframe transactions, we hope to give some powerful applications a fresh, usable look, without having to modify those applications in any way.

This, of course, implies the expense of a significant software development effort on top of an already overburdened data processing budget. But one of our central points is that we can't afford **not** to respond to this evolutionary process. By ignoring the emerging needs of a new class of users, we jeopardize our enormous investment in administrative data and the means to deliver it, and we miss the chance to significantly increase user productivity.

What's already in place

The opportunity is there because a significant computer infrastructure is already in place and potential users are relatively skilled and eager to move ahead. The UW-Madison is a major research and teaching university with 42,000 students, 16,000 faculty and staff, and an annual budget of more than $1 billion. UW-Madison's annual research budget is $309 million.

Over the last 20 years, $25 million has been spent to develop and maintain UW-Madison's mainframe applications. Administrative systems are entirely data base (DL/I through DB2) and entirely online. Applications are highly integrated (for example, common Student data bases and Personnel data bases).

This is a solid foundation, and a well equipped and knowledgeable community of microcomputer users is ready to take advantage of it. More than 12,000 micros are installed at UW-Madison, many of them networked. This equipment base is becoming increasingly powerful as users upgrade. The users themselves are a diverse group, comfortable working in both DOS and Macintosh environments. They are skilled at running a large number of micro-based software applications that are hungry for data (such as spreadsheets and data base packages) and operate with graphical interfaces that are coming of age.

Along with this growing and appropriate reliance on microcomputers at UW-Madison, we see a user population in transition. A large portion of that population still uses the hundreds of 3270 terminals that remain in offices across the campus. These devices are still economical for today's processing tasks, and it would be imprudent to *stop* supporting existing applications that run on them.

The other portion of our user population is increasing its demand for:

- applications that look like the microcomputer applications with which they are familiar
- connections that happen automatically.

The latter group is growing and loudly saying that they want administrative data in *their* format on *their* desktop. Given the power sitting on those desktops, the University will benefit by responding to their demands.

Our challenge, then, is to make possible the effective use of micro-based software tools with centralized administrative data. We must deliver data in a way that is consistent with the users' familiar microcomputer applications. And for that to happen, administrative applications must be able to integrate with the micro's data base packages, word processing and spreadsheet programs, and other applications.

So, what are we doing?

Our immediate response is a wide-ranging effort to build "tailored user interfaces." A tailored user interface (TUI) is a presentation of an application that is consistent with a user's familiar micro environment. A single application (such as the Library's Online Catalog) will have several *different* TUIs for different users and classes of devices; for example, a 3270 view for users with those older devices, and Macintosh and Windows 3.0 views for users who run these systems on their desktops.

(Over the long term, we intend to increase emphasis on a client/server approach, with the presentation and part of process on the client, and the remainder of process on the server. This is not possible now, however, because industrial-strength development software is not yet widely tested. In any case, we still need to support old devices for the foreseeable future. So our short-term focus is on the tailored user interface.)

We have already built some tailored user interfaces for UW-Madison. First came two prototypes:

- In the fall of 1990, we completed work on a new interface to a widely used name-search transaction. This prototype totally shielded the user from the 3270 transaction process, substituted a scrollable response list for the traditional 3270 paged response, and modified the screen presentation of the data.
- In the spring of 1991, users of Macintosh computers connected to the campus network via TCP/IP were able to gain access to the UW-Madison Library's On-line Catalog. This TUI used the Mac Hypercard system to create a view of the Library's catalog that was completely Mac-like in appearance and operation. Instead of the usual command line entry, this TUI offered buttons, menus, submenus, and enterable areas to help the user create the query. It also provided windows and scrollable lists of query responses.

Next came pilot production use of TUIs:

- Another interface for Macintoshes made available in the fall of 1991 enables users to send PostScript files to central high-speed laser printers.
- In the spring of 1992, students were given access to a 3270 student information transaction using a touch-screen interface for devices running under Windows 3.0. Micros placed in the student unions, in the administration building, and in student labs across campus will be equipped with this interface. Students use this touch-screen TUI to view current course lists, past semesters' data, academic holds and fines data, and to modify their addresses.
- We are developing a tailored user interface on the mainframe for the "10 most popular" 3270 transactions; this is especially important for infrequent users.
- We have developed a 3270 interface filter that runs on the host and is invoked to shield users from the idiosyncratic operation of IMS/VS, our principal teleprocessing monitor. This filter traps most of the cryptic "DFSnnnn" messages (that is, system-oriented gobbledygook) and replaces them with meaningful messages and help for users. For example, the filter changes "DFS223 PAGE NOT CONTAINED IN CURRENT MESSAGE" to read "THE PAGE REQUESTED DOESN'T EXIST." Several options are then displayed, including starting at the beginning of the page list, displaying the most recent page, or just quitting the transaction.

Access to the host-based prototype and pilot interfaces will be widespread. Macintosh access to the Library Catalog will be available in student computer labs across campus. The Macintosh interface for sending PostScript files to the high-speed laser printers is available from any Mac connected to the campus network. The TUI to the 10 3270 transactions and the interface filter can be used from anywhere (campuswide, statewide, or beyond using TCP/IP) by anyone with 3270 access.

How are we doing it?

We began our tailored user interface development by looking for the shortcomings of the current interface. Part of that process included videotaping a subject unfamiliar with 3270 trying to use an old-fashioned 3270 transaction with a microcomputer. We later interviewed the subject to elicit opinions and further determine how the interface could be improved.

We also interviewed micro- and minicomputer users who routinely use our transactions from those devices. We asked them what they liked, disliked, and would change given the opportunity. The consistent response was that the transactions were invaluable but the interface was designed for a different device in a different era.

We developed our prototype and pilot TUIs using "frontware," which is the software environment, or set of tools, for developing TUIs. These tools are also called "screen scrapers" — software that "scrapes" the data off the 3270 screen and deposits it on the TUI. The frontware we used included:

Macintosh Hypercard system, which we used to manage the user presentation and query creation functions for the prototype Library TUI. The communication aspects are handled using the Mac's MacTCP software.

Macintosh MacApp object-oriented environment, used to write the pilot Library TUI (code-named Conan the . . .). Again, we relied on MacTCP for the communication element.

Toolbook object-oriented software from Asymetrix, running under DOS 4.0 and Windows 3.0, used to write the touch-screen interface for the student information system. The communication activity is supported using IBM's Personal Communications - 3270 version 2.

TPX (Terminal Productivity Executive), a mainframe product from Legent, used to provide scripting of mainframe transactions. TPX enables the user to select many mainframe transactions from a single menu. We can customize this menu to ease the logon/signon process for users. We are also considering **Natural Connection** for use as a transaction-scripting environment.

A common trait of these solutions is that the underlying transactions remain unchanged. We need not revisit these applications and their code. We make it easier to access and work with many transactions, and we modify the presentation dramatically on others. This is the key to leveraging the investment in 3270.

A risk with this approach, however, is the possibility that the underlying transaction may change, which would necessitate a corresponding change to the TUI. This requires careful selection of transactions for TUI development. Volatile applications are poor candidates, obviously; better choices are highly used, stable transactions or those that are just becoming available to new user communities; in the latter case, the risk may be worthwhile in return for greater acceptance for and higher use of the organization's data resource.

Development of TUIs has been a team effort. As mentioned above, user advice was critical. Also, staff from UW-Madison's academic computing center were heavily involved. ADP staff on the project included people from the technical support, applications development, and office automation support groups.

A range of skills was needed to develop the TUIs, including some that were not particularly technical. Of course, we needed people with a solid knowledge of our campus and statewide networks, people with experience working with microcomputer software, and people knowledgeable about mainframe applications.

We also found that a *lack* of knowledge can sometimes pay dividends. When we were designing the user interface for the student information touch-screen application, we gave the job to a student instead of a veteran mainframe developer. The student was familiar with arcade games and with graphical interfaces on microcomputers. This gave our TUIs the look and feel of the interfaces familiar to our new class of users.

Remaining Issues

Our efforts to develop tailored user interfaces are not complete, and several issues must still be resolved.

Software distribution — We must implement ways to get the TUI software into the hands of the people who need it. Many of the technical problems with software distribution have been solved; the problem is really one of staffing, equipment, space, and recordkeeping.

Software maintenance — Once the software is distributed, it will need upgrades and error fixes. Defective copies will have to be replaced. Again, this will pose a logistical challenge and imply a resource commitment from the University for ongoing support.

Standards supported — Several new but important de facto standards are emerging in microcomputer operating systems, LAN topologies, interfaces, software tools, and other areas. At an institution as large and diverse as UW-Madison, we can expect that most of these standards will be adopted by significant numbers of users. The extent to which we support any or all of these standards is a serious issue.

Cost/staff — One of our main points is that we can't afford **not** to develop tailored user interfaces. The viability of our organization's central data resource may depend on our ability to make it useful to people.

But prevailing economic conditions will impose severe limits on our ability to deliver TUIs. We must determine the numbers of staff and other resources needed to develop even a minimal set of TUIs and then seek funding. Our prospects are uncertain at best.

Reaction of users familiar with old transactions — Much of our existing user population is still satisfied with the old interface and, frankly, unconvinced of the need for change. Many of them view the advent of TUIs as disruptive to their work. They are correct. Any changes to their procedures will affect their productivity, at least for the short term. Some mix of selective implementation, training, and persuasion may be needed to deal with this. Again, resource limitations will probably dictate how this issue is resolved.

Finite life of the interfaces — The product of our TUI development effort may not have a long life. As UW-Madison migrates to a "real" client/server environment, many of the interfaces developed in this project will be superseded. This will pose an immediate problem as we seek funding to develop and implement TUIs. Budget-conscious administrators may be reluctant to allocate resources to what they may perceive as a stop-gap approach to user friendliness.

We plan to address this short-term problem by outlining the advantages of developing TUIs now. This will be easier if we select candidates for TUI development based on the benefits to be derived over their relatively brief useful life.

Tradeoffs, or balancing what's possible (and good) with what's affordable and economical — As with most information systems development, we must take care not to develop TUIs beyond the need they are designed to satisfy. We must keep in mind that the client-server model continues to evolve and will be available in production settings. Our current development can't be confused with that model.

Therefore, we must guard against building into these stop-gap TUIs all the features and functions we expect the client-server to provide. Forcing these systems to look and feel like real client-server systems would delay the arrival of client-server, increase its cost, and deplete the resources that could otherwise be directed toward client-server design and acquisition.

Results

UW-Madison has responded to our TUI development effort with enthusiasm and excitement, although formal assessment of success has been difficult. The development team clearly recognizes, however, that our initiative has better equipped us for future work in the integration of centralized data with microcomputers.

How to measure success? — We have interviewed users of both the traditional systems and the TUI products. We asked users of the student information transaction's touch-screen interface for their comments.

In addition, some observational data was collected for the touch-screen TUI. We piloted a few of the touch-screen devices by placing them next to traditional 3270 terminals. Predictably, students queued up to use the touch-screen version and shunned the old terminal system.

We plan a formal survey for the student information transaction's TUI and for the Library Catalog TUI to assess their acceptance and identify any needed changes. The survey will be done by a campus-based survey research laboratory, and the results will be made available to such administrative offices as the Division of Information Technology, the Registrar's Office, and the Director of the General Library System. The survey results will guide additional investments in TUI development and changes and upgrades to existing systems.

We also hope to collect information online by asking users, on a random basis, about the product they are using. We want to do this across the board on our transaction systems, not limit ourselves to the TUIs, and include the scripted transactions and the generalized mainframe interface as well. These random, self-administered surveys would be primarily anecdotal but could give us valuable information about user preferences and potential problems.

A good learning experience for future client/server applications! — TUI development has been good experience for the coming client-server-based computing model. Our exposure to the world of microcomputing should be invaluable as we move closer to client-server. We now better appreciate the power and integration capability of micros. We have more knowledge of how our future systems must operate and what tools are available now for us to begin writing client-based code.

We have a better understanding of the communication and application interplay required to bring distributed data and processes to the desktop. From our work with the micro user community, we are more sympathetic to their struggles with the traditional 3270-host interface.

Finally, we are more aware of the urgency of seamlessly integrating centralized data with microcomputers. When access to host data is perceived as clumsy, time consuming, and error prone, users have a tendency to regard the central data resource as a liability. Those of us who manage that resource must hear and heed that message.

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T4-5

Campus Wide Information System: Statewide

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CAMPUS WIDE INFORMATION SYSTEM:
STATEWIDE

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ABOUT APPALACHIAN.

Appalachian State University is a member of The University of North Carolina System which consists of 16 campuses plus the North Carolina School of the Arts and the North Carolina School of Math and Science.

Appalachian is located in Boone in the western mountains of the state approximately 14 miles from the Tennessee border and 26 miles from Virginia. The elevation is 3,333 feet or one kilometer high. Because of the elevation it is a summer resort for many residents of the South. There are 15 golf courses within 15 miles of Boone and five ski slopes for the winter sports enthusiast.

Computing equipment consists of a Digital Equipment Corporation cluster including an 8650, 8550, 6000-350 and a VAXStation 3100. An IBM 9370 is used by the College of Business for instructional purposes. Other computers are operated by the Math Science department and Library. There are over 1,600 microcomputers and workstations in use throughout the University.

Enrollment is approximately 11,000 FTE with a budget of $105 million.

WHAT IS A CAMPUS WIDE INFORMATION SYSTEM (CWIS)?

There are numerous definitions of what a Campus-Wide Information System should be but Appendix A is a fairly complete outline of the attributes of a system.

Our system contains most of the features in the description. We have not determined what was meant by access from electronic mail and we do not have a 3270 access procedure.

Some descriptions include a master menu to access all resources offered by computer systems on a campus. Our view is more limited. We have provided access to most administrative systems through the ALL IN 1 Office Automation System as well as to the CWIS. The CWIS contains a general information base as opposed to a data base but we may also access data bases from the CWIS, as we will describe as we talk more about the details of our system.

DEVELOPMENT OF OUR CWIS.

Our CWIS is based on Digital Equipment Corporations' VAX VTX system which is a menu driven system.

When DEC first announced the availability of VTX we contacted our representative and discovered that the cost to operate the system on our configuration was too great for our budget.

North Carolina State installed the system on one of their DEC computers and made it available to us on a dial-up basis. We determined that we could purchase a small computer and get the software for a small license fee.

We proposed to the Associate Vice Chancellor For Academic Affairs, to whom we report, that we demonstrate the system to the University Administrative Cabinet to see if they would approve our continuing our examination of the system. Even with some communications problems with the dial-up line we made a successful demonstration of the North Carolina State system as well as the University of North Carolina - Chapel Hill system which was linked to the NC State system.

The Cabinet approved our exploring the system capabilities and a committee was appointed to guide and evaluate the efforts. The Committee consisted of a representative of the Chancellor, each Vice Chancellor, the faculty and the student body. Members of our staff were ex-officio members of the Committee.

In the meantime, DEC announced the Campus Software License Grant which allowed us to install VTX on our cluster at the cost of the media and documentation.

The system uses a page numbering scheme that permits the storage of 32,767 sub pages (screens) of information for every menu item.

The first task is to decide on the menu numbering scheme you wish to use. Page 0 is always the main menu page. Our final numbering scheme uses a zero in front of all main menu items. For instance, the first main menu item, Directories, is page 01. The tenth item on the main menu, Uncle Sigmund, is page 010. Sub menus for each of the main menu items add to the numbering scheme. Again, the menu item that allows persons to submit questions to Uncle Sigmund is numbered 01001 and the option to read the answers of Uncle Sigmund is numbered 01002. Information pages are separated from menu pages by a decimal. Continuing with the example of Uncle Sigmund, the first answer page would be page 01002.00001. The second information page would be 01002.00002. Thus the system can support almost an infinite number of information pages, limited only by the disk space available.

VTX also supports the DECTalk voice response system. This fact influenced our final menu scheme because the number 1 must be reserved for the options that are available on both VTX and DECTalk. Our DECTalk system supports a job opening list and the information is also accessible on the VTX screens from a menu item.

PHILOSOPHY OF IMPLEMENTATION.

Early in the process we determined that our office could not take responsibility for entering all the information into the base. We wanted the people who managed the information to submit the information.

We obtained a program written in the C language from the Chapel Hill campus that had originally been done by NC State. This program simplified the process to the point that secretaries who were familiar with any word processor could prepare the information for inclusion in the system. We developed a training program to train VIPs (Videotext Information Providers). We give them instruction on the codes they need to place in their information to load it to the proper page in VTX and to build in keywords and titles. We show them how to highlight their information and to control the way it will appear on the finished screen.

THE IMPLEMENTATION PROCESS.

The Committee drew up a list of 25 items (See Appendix C) which they felt were likely candidates for inclusion in the project and indicated the items to be included in a pilot program. The pilot program items were:

Faculty, staff and student directories.
Staff and student employment listings.
Calendar of events.

The student directory was very easy. We immediately built an information base from the Student Information System. The faculty/staff directory was more difficult. This directory has traditionally been constructed for paper publication by the University Telephone office and the Student Publications office. The student office entered information onto a MacIntosh computer from material collected by the Telephone office and then sent it to the publisher. We obtained a copy of this material in Microsoft Word and converted it to ASCII format for use on the VTX. In the process we proposed that we use a feature on ALL IN 1 to allow the Telephone office to maintain the directory on a continuous basis and we would build the information base from that file. This saved many person hours of editing and proofing and provided an updated directory all year.

The Personnel Office immediately agreed to post the staff openings and the Career Planning and Placement office soon posted part-time student employment opportunities. This completed two of the three areas specified by the Committee.

Item three, Calendar of Events, was the most difficult of the three to complete. This information is not centralized in the University but is maintained by many offices on campus. Student Programs produces a calendar in printed form to be distributed to students at the beginning of the year but the information is soon out of date and does not contain all items from all areas. We initially converted this information from MULTIMATE documents into VTX but continued to work with the offices to get them to provide the information directly.

The University Information Office produces a weekly newspaper for faculty and staff and they agreed to provide that for inclusion in VTX. We quickly realized that calendars and news were areas that should be separated but news items did list events that were also calendar items. These two items met the minimum requirement for the pilot. Subsequently, many offices have contributed schedules of events to the system. But no office has taken responsibility for maintaining an all encompassing calendar.

Through the use of the keyword and title capability of the VideoText system and the cooperation of the VIPs, we now enter a date keyword in all calendars that permits users to enter an abbreviation of the month and a date and receive a list of all activities for that day. Without requiring some office to maintain a University wide calendar, we provide that service.

During the pilot program we continued to work on the 25 items the Committee had identified. The successful completion of the pilot was certified by the Associate Vice Chancellor after one year of operation during which the usage grew to over 40,000 page accesses per month.

HARDWARE AND EMULATOR PROBLEMS.

We soon discovered that VTX appeared and operated differently to users of the system depending on the hardware and/or emulator they were using. Since the system was oriented to DECs' VT series terminals and commands, many people found that it was very cumbersome to use and the project was in danger of failing almost before it got started. It wasn't that we had not anticipated the problem but we did not anticipate how extensive the problem really was.

We constructed help screens that gave key combinations for several emulators with which we were familiar and for ALL IN 1. But emulators of many types and varieties came out of the woodwork. One professor accused us of not being sensitive to the users needs.

Fortunately, New Mexico State University came to our rescue. We found that they had built an equivalency table of commands using simple easy to use and understand mnemonics like B for "backup" and F for "find". We immediately asked for the modification and installed it. We received a message from our friend, the professor, saying he now thought we really did care about the user.

We had another problem with the public terminals that we had installed. The set-up key was identified prominently and students will experiment. We had a call from the Student Union that the information desk terminal was not operating. When we checked it out we found that someone had used the set-up key to change the language for the device from English to the Finnish language. It was a little difficult to understand what you were changing.

As a result of this experience we physically moved the key to another location but some people were not fooled by this maneuver and we continued to have problems. We finally disabled the set-up key on the public terminals.

USING THE SYSTEM.

The installation of the New Mexico State University modification to simplify the use of the system made it possible for persons unfamiliar with computer terminology to easily use the system.

The system is a menu driven system but with a strong keyword capability to help locate specific information without going through several levels of menus. Both approaches provide the casual user with few obstructions. Information from other organizations suggests that you should not require users to go through more than three levels of menus to find the information for which they are looking.

Following you will find a copy of the main menu of the system. You simply enter the number of the choice you wish and press the return key. In most cases, there are two or more levels of menus associated with each choice. Your trip through the menu system is the same as for the main menu. You make a choice that leads you to the information you seek.

MAIN MENU

```
Welcome to the Appalachian State University VideoText System

    This is an electronic bulletin board for the use of
Students, Faculty, Staff, and Visitors.  ONLY HIGHLIGHTED
OPTIONS ARE AVAILABLE.

    95)  TO OBTAIN A QUICK LIST OF AVAILABLE INFORMATION
1) Directories                  10) Ask Uncle Sigmund
2) Employment                   11) Scholarly Resources
3) Calendars and Events         12) Courses/Seminars
4) News                         13) Buy/Sell/Trade etc
5) Facts About Appalachian      14) Career Development
6) Libraries at Appalachian     15) Other Information Systems
7) Univ Policies/Procedures     16) List Todays' Activities
8) Computer Information         17) APPALCART ROUTES
9) Student Activities/Programs

  Please enter the number of your choice and press the Return
key!

              NEW ITEMS?    PRESS <RETURN>

Commands:  (F)ind)  (H)elp  (E)xit  (Q)uit
```

Once the user becomes accustomed to using the keyword system they may proceed directly to the information they seek. Appendix B is the index of information available at the time of this writing and is choice 95 on the main menu. This choice allows the user to see the items contained in the system and indicates the keyword to be used to retrieve that information. A keyword search may be initiated from any page. The menu coordinates are also provided should the user wish to use the menu method. Appendix B is also an example of the codes and information that is supplied by the VIPs to customize the document for VTX presentation.

Following are some of the more interesting applications on the system:

> UNCLE SIGMUND: This allows faculty, staff and students to enter problems that bother them and the staff at the Counseling Center provides suggestions for assistance etc. The hope is that persons who will not identify themselves by coming to the Center may get help or realize how serious their problem is and take the recommendations of the Center to take action.
>
> BUY/SELL/TRADE: Faculty, staff and students may enter ads but they must enter their University ID and name as it appears on the official records before the ad is accepted. Since we can positively identify the submitters we have not had a problem with foul language or pornography. One ad offering a prostitute was submitted but since the submitter did not use their real name it was rejected. Had they used their real name the ad would have been deleted and they would have been reminded of our policy on use of computers and networks which prohibits this type of usage at the risk of loss of computer privileges or worse.

LIST OF TODAY'S ACTIVITIES: Today's date, or any date for that matter, may be used as a keyword and obtain a list of activities for that date.

USA TODAY Headlines: This is available to University personnel only, because of our contract with the provider. Each day, usually before 7am, this information is automatically loaded to VTX.

RESOURCE MANUAL: This consists of all University policies and procedures. The keyword system provides a list of specific topics so the user may go directly to the item they wish.

The title of this presentation is "A Campus Wide Information System: Statewide." Choice 15 on the main menu provides the opportunity to select the CWIS for four other University of North Carolina campuses and they may also access our system. Other campuses are planning to join us. We could eventually have all sixteen Universities in our Campus Wide Information System.

One of the goals of the statewide CWIS is to share the burden of information input for items that are of interest to all locations. The Chapel Hill campus currently maintains a newsletter on aging which is of general interest. They also have available extensive information on grants availability. The Greensboro campus provides the Internet Resource Guide on their CWIS and North Carolina State is maintaining the North Carolina microcomputer purchase contract on their system.

RESOURCES EXPENDED IN INSTALLING AND OPERATING THE SYSTEM.

The Manager of Administrative Systems spent part-time over a six month period getting the system set up and running. He is still involved when some unusual application has to be developed. We have been requested to make personal student information available, such as, grades, Financial Aid and account balances. This will require interfaces to the student information system, and design of a security system to assure privacy.

DEC recommends two people be continually involved. They are called the VTX Manager and VTX Operator. The VTX Operator is our DEC System Manager and the VTX Manager is your presenter. Now that the system is operational the Operator probably spends no more than one half hour per day. The VTX Manager averages about three quarters of an hour per day. The Manager controls the development of the menu structure and authorizes the use of pages to VIPs through a security system that prevents persons from one area overlaying another persons' information.

The Training Center continues to provide training classes for new VIPs so they spend two to four hours per month teaching and this group also serves as the Help Desk and answer most calls for help.

Computer overhead costs for August 1991 when we had 63,121 accesses to pages on the system were:

DISK SPACE: 111,104,000 BYTES
PUBLIC TERMINALS: 15
COMPUTER CPU SECONDS: 30288.19
INPUT/OUTPUT ACCESSES: 6,434,215

Users that sign on with a valid user id have all activity posted to their account.

SUMMARY

Our system has been very successful but we still have a number of the 25 items suggested by the Committee remaining to be done. We are sure that if we had information entry personnel we could install many more of the 25 items. The information is the responsibility of many offices and therefore needs to be maintained by those offices. If we post the information it will soon be out of date and we will be unaware of the changes.

We have visited with the Vice Chancellors to ask that they support the system by encouraging their departments to participate. The Vice Chancellor of Student Development has been very helpful. He directed that his areas would provide information so the items of student interest are very numerous. The Audits and Systems office is loading the Resource Manual and they plan to maintain it. The paper manuals in most departments are very out of date despite Audits and Systems efforts to send out changes in a timely manner.

High level administrators don't seem to take time to see for themselves what is available and evaluate what the CWIS might do for communications within the institution.

It is our feeling that the system is providing a very valuable service at a small cost. We will continue our efforts to include the items originally suggested and implement new suggestions that are approved by the Committee.

APPENDIX A
PROPOSED FEATURES OF A CWIS

From: Benjamin E Chi <BEC@ALBANY.EDU>

1. The Front End -- the User Interface

   - The service must be accessible without requiring the user to have a mainframe account.

   - On the other hand, the service must be accessible to a logged-on user without requiring him to log off. In particular, if the user is logged onto the home machine (the machine on which the service is running), he should be able to access the service via an ordinary program call.

   - The service must be accessible to a user at ANY networked keyboard on campus.. This includes, for example, a user on a departmental (Novell, say) network which is connected to the backbone.

   - The service must be accessible to "foreign" users via dial-up and telnet.

   - The service must be able to provide private information to users (e.g., transcript, degree audit), and thus must be able to perform user authentication.

   - The service (or some subset of its features) must be accessible to a user via a touch-tone telephone. Responses will be through the use of a voice synthesizer.

   - The service (or some subset of its features) must be accessible via electronic mail.

   - The service must not require an excessive amount of initialization activity. That is, the user must not be required to negotiate a maze of menus or commands just to get to the service.

   - The display must be attractive and strike a balance between readability on the one hand, and an avoidance of overly deep menu trees and overly many screens containing sparse information on the other.

   - The information must display properly on both 3270- and VT100-style terminals. An example of the problem

     here is the results one gets if he telnets from a VM machine running IBM's TCP/IP suite "FAL" to a DEC running VideoTex. The result is a mess unless there is some secret I don't know about.

   - The command structure must be "user-friendly" and intuitively obvious. The user must not require training to successfully use the service.

2. The Back End -- the Data Structures

One of the major problems faced in maintaining the services is that of keeping the entries current. Another is that submissions can originate from almost anywhere. This leads to the following needs:

- Contributors must be able to submit entries or updates via any reasonable medium -- floppy disk, mail, file transfer, database extract, etc.
- The format required for contributors' submissions should not be overly burdensome. Preprocessors must exist to reformat submitted data into a form suitable for online search and access.
- Special preprocessors need to be written for submissions from non-people -- the UCAR weather data, for instance.

APPENDIX B
INDEX TO AVAILABLE INFORMATION
AND
EXAMPLE OF DOCUMENT PREPARED BY USER

This document is included exactly as it would be prepared by an Information Provider for the first two screens. We have removed the control information beyond that point to save space.

Following is an explanation of the commands inserted by the provider:

.bp (begin page) followed by the page number.
.is (insert) the description which follows, on the last line on every screen. Used only once per document.
.ti (title) is used to identify items when more than one item has the same keyword.
.ke (keyword) for this item of information. Up to 30 per page allowed.
.bo (bold) begin bolding information.
.no (stop) stop bolding or other functions.
.pb (page break) allows provider to decide where page should end. Otherwise system automatically inserts a page break every twenty lines.
.in (reverse video)
.bt (begin text)

Other accenting commands exist but we have found we cannot depend on emulators handling the screens in a consistent manner.

```
.bp095
.isINDEX TO AVAILABLE INFORMATION
.tiINSTRUCTIONS ON USE OF INDEX
.keINDEX
.bt

     .boTO USE THE KEYWORDS LISTED IN THIS INDEX:.no

     .boTYPE:.no  .boF.no and press the <return> key.

     .boTHEN TYPE:.no  The keyword indicated in the KEYWORD
column and press <return>.

     .boFOR EXAMPLE:.no
     To find the Student Directory at Chapel Hill you would
type F <return> then STUDIR <return>.  This procedure will
take you directly to the Student Directory on the Chapel Hill
Campus.

     TO RETURN TO THIS INDEX TYPE F and press return then
INDEX and <return>.

     PRESS RETURN TO GO TO THE FIRST PAGE OF THE INDEX.
.pb
.tiACADEMIC COMPUTER USER SERVICES - BASKETBALL, INTRAMURALS
.keINDEX
.bt
```

SUBJECT	KEYWORD	MENU SELECTION
ACADEMIC COMPUTER USER SERVICES	ACS	8,3
ACADEMIC POLICIES AND PROCEDURES	APP	7,1
ADD A CLASS, LAST DATE TO	ADD	3,1
ADMIN POLICIES, RESOURCE MANUAL	ADMIN	7,7
AGING, LETTER ON (UNCCH)	AGING	15
ALUMNI, JOB OPPORTUNITIES	ALUMJOB	2,3
APPALACHIAN COMPUTING PROFILE	COMPUTING	8,1
APPALACHIAN DATA NETWORKS	NETWORKS	8,4
APPALACHIAN, FACTS ABOUT	FACTS	5
APPALACHIAN, GENERAL INFORMATION	GENINFO	5,1
APPALACHIAN SCENE	SCENE	4,1
APPALACHIAN SUMMER	SUMMER	3,5
APPALCART ROUTES/SCHEDULES	CART	17
ART EXHIBITS	ART	3,5,4
BASKETBALL, INTRAMURALS	BASKETBALL	9,2
BASKETBALL, VARSITY (MENS & WOMENS)	BASKETBALL	3,8
BELK LIBRARY	BELK	6,1
BOWLING, INTRAMURALS	BOWLING	9,2
BUY/SELL/TRADE/ETC	BUY	13
BYTES AND PATCHES	BYTES	8,2 OR 4,6
CALENDAR, GENERAL	GENCAL	3,9
CAREER DEVELOPMENT SERVICES	CAREER	14
CLASSES, SCHEDULE OF, SUMMER 1	SUM1	12,3
CLASSES, SCHEDULE OF, SUMMER 2	SUM2	12,4
CLASSES, SCHEDULE OF, FALL TERM	FALL	12,5
CLUB SPORTS	CLUB	3,10
COMPUTER AND MANAGEMENT SERVICES	CMS	8,3
COMPUTER INFORMATION	COMPUTING	8
COMPUTERS, MICRO/PURCHASE PLAN	COMPUR	8,2
COMPUTERS, POLICY ON USE OF	COMPUSE	7,6 OR 8,6
COMPUTING PROFILE, APPALACHIAN	COMPUTING	8,1
DEPARTMENT SEMINARS/LECTURES	SEMINARS	12,2
DIRECTORY, ELECTRONIC MAIL	EMAIL	1,5
DIRECTORY, FACULTY	DIR	1,1
DIRECTORY, FACULTY/STAFF (UNC-CH)	FACSTAFFDIR	15
DIRECTORY, FUNCTIONAL	FUNCT	1,3
DIRECTORY, STAFF	DIR	1,1
DIRECTORY, STUDENT	DIR	1,1
DIRECTORY, STUDENT CHAPEL HILL	STUDIR	15
DROP A CLASS, LAST DATE TO	DROP	3,1
ELECTRONIC MAIL DIRECTORY	EMAIL	1,5
EMPLOYMENT, ALUMNI FULL-TIME	ALUMJOB	2,3
EMPLOYMENT, STAFF	STAFFJOB	2,1
EMPLOYMENT, STUDENT FULL-TIME	STUFT	2,3
EMPLOYMENT, STUDENT PART-TIME	STUPT	2,2
EXAM SCHEDULE	EXAM	3,3
FACULTY DIRECTORY	DIR	1,1
FILM LIBRARY	FILM	6,4
FITNESS CLINICS	FITC	3,10
FITNESS SEMINARS	FITS	3,10
FOOD SERVICES SCHEDULES	FOOD	3,6
FOOTBALL, VARSITY	FOOTBALL	3,8
FORUM SERIES	FORUM	3,5
FUNCTIONAL DIRECTORY	FUNCT	1,3
GENERAL CALENDAR	GENCAL	3,9
INTERNET RESOURCE GUIDE (UNC-G)	IRG	15
INTRAMURALS	INTRA	9,2
INSTRUCTIONAL MATERIALS CENTER	IMC	6,3
LIBRARIES	LIBRARY	6,1-7

SUBJECT	KEYWORD	MENU SELECTION
LIBRARY SCHEDULE	LIBSCH	3,7 OR 6,1
MAP LIBRARY	MAP	6,7
MICROCOMPUTER PURCHASE PROGRAM	COMPUR	8,2
MICROFORMS COLLECTION (LIBRARY)	FORMS	6,5
MUSIC LIBRARY	MUSIC	6,2
NETWORKS, DATA	NETWORKS	8,4
NEWS, APPALACHIAN SCENE	SCENE	4,1
NEWS, PC TRAINING CENTER	PCTRAIN	4,4
NEWS, USA TODAY HEADLINES	USA	4,8
NEWSLETTER, ACADEMIC COMPUTR USERS	BYTES	4,6 OR 8,2
NORTH CAROLINA STATE INFORMATION STATE	NCSU	15,1
PC TRAINING CENTER NEWS	PCTRAIN	4,4 OR 8,5
PERFORMING ARTS SERIES	PERARTS	3,5
PERSONNEL, RESOURCE MANUAL	PERSONNEL	7,7,11
PLAN, UNIVERSITY 1988-1993	PLAN	7,10
POLICY ON USE OF COMPUTERS	COMPUSE	7,6 OR 8,6
PUBLIC HEALTH, CONT ED (UNCCH)	PUBLIC HEALTH	15
QUINN CENTER SCHEDULE	QUINN	3,10
RESOURCE MANUAL	RESOURCE	7,7
SCHEDULE OF CLASSES, SUMMER 1	SUM1	12,3
SCHEDULE OF CLASSES, SUMMER 2	SUM2	12,4
SCHEDULE OF CLASSES, FALL TERM	FALL	12,5
SCHOOL OF MUSIC PERFORMANCES	MUSIC	3,5
SEMINARS, DEPARTMENT	SEMINARS	12,2
SIGMUND, UNCLE	UNCLE	10
SOCCER, VARSITY	SOCCER	3,8
SPECIAL ANNOUNCEMENTS	SPECIAL	4,9
SPORTS, VARSITY	VARSITY	3,8
STAFF DIRECTORY	DIR	1,1
STAFF EMPLOYMENT OPPORTUNITIES	STAFFJOB	2,1
STUDENT DIRECTORY	DIR	1,1
STUDENT UNION SCHEDULE	UNION3,4	
STUDENTS, IMPORTANT DATES FOR	DATES	3,1
SWIMMING POOL SCHEDULE	POOL	3,10
THEATRE AND DANCE	THEATRE	3,5,5
TRAVEL, RESOURCE MANUAL	TRAVEL	7,7,19
UNC CHAPEL HILL INFORMATION CHAPEL_HILL CAROLINA	UNCCH	15,2
UNC GREENSBORO INFORMATION GREENSBORO	UNCG	15,4
UNC WILMINGTON INFORMATION WILMINGTON	UNCW	15,5
UNCLE SIGMUND	UNCLE	10
UNIVERSITY PLAN	PLAN	7,10
USA TODAY HEADLINES	USA	4,8
VARSITY SPORTS	VARSITY	3,8

APPENDIX C
ADVISORY COMMITTEE
VIDEOTEXT SUGGESTION LIST

TOPIC	AUDIENCE			
	STUDENTS	FACULTY	STAFF	PARENTS/ VISITORS
STUDENT DIRECTORY	X	X	X	X
CALENDAR OF ACTIVITIES	X	X	X	X
EMPLOYMENT OPPORTUNITIES	X	X	X	
FACULTY/STAFF DIRECTORY	X	X	X	X
APPALACHIAN SCENE (NEWSLETTER)	X	X	X	X
NEWS AND EVENTS	X	X	X	X
CHART OF ACCOUNTS		X	X	
RESOURCE MANUAL		X	X	
VISITOR INFORMATION				X
COMPUTER INFORMATION	X	X	X	
COURSE SYLLABI	X	X	X	X
PARKING REGULATIONS	X	X	X	X
APARTMENT AND RIDE INFORMATION	X	X	X	X
COMMENTS AND SURVEYS	X	X	X	X
HANDICAPPED ACCESS	X	X	X	X
MINORITY RECRUITMENT (FACULTY)		X		
LAW AND LEGAL		X	X	
PROPOSED POLICY/COMMITTEE ACTIONS	X	X	X	
SKILL/EXPERTISE INVENTORY	X	X	X	X
FACT BOOK-INSTITUTIONAL DATA	X	X	X	X
COURSE AND SEMINAR AVAILABILITY	X	X	X	X
COURSE CATALOG	X	X	X	X
CLOSED CLASSES/REGISTRATION	X	X	X	
BUY/SELL/TRADE	X	X	X	
APPALACHIAN CONSORTIUM		X		X

37th Annual College and University
Computer Users Conference

"Discover New Worlds With Technology"

W1-1
CHRONOS - Master of Time

William Parmenter
Purdue University
Edward Mooney
Montana State University

CHRONOS - Master of Time

William J. Parmenter
Senior Software Engineer
Purdue University

Dr. Edward L. Mooney
Associate Professor
Montana State University

Abstract

The problem of assigning rooms and times for University class meetings is paradoxically both hard and easy. It is easy enough that people, often with minimal mechanical aid, can do a seemingly good job of it, especially if they have a lot of experience and/or power and minimal expectations or measures of optimality of results. It is mathematically provable, on the other hand, that the enumeration and evaluation of all the possible choices for an ordinary-size University, even with the most powerful computers available, would take geological quantities of time.

The CHRONOS system supports departmental personnel in their schedule-construction decisions, taking into account considerations of room size and suitability, instructor availability and preferences, student interactions, and section time requirements. As much of the schedule as is desired may be preset, so that CHRONOS may be used in an incremental mode to minimize disruption of faculty and students when a late timetable change needs to be made.

CHRONOS has been used at Purdue University to schedule large lecture rooms for the Spring 1992 semester in parallel with manual scheduling. Expert schedulers were unable to distinguish the mechanized schedule from the human-generated one, so Fall 1992 will be scheduled by machine only. There were 476 sections and 190,000+ student contact hours (about half of the student contact hours on campus) involved in this problem.

Decision Support Overview

The need to solve problems seems to be basic to any form of human endeavor. The process of problem-solving may be resolved into three steps as follows: identify solutions, evaluate solutions, choose the "best" solution. Some limitations on this process include lack of information needed to identify or evaluate solutions, and lack of time to evaluate all of the identifiable solutions.

Problem solutions are defined by (possibly large sets of) decisions. Goals are used to differentiate between solutions, and constraints restrict decision subsets. Clearly, we hope to find the best (in terms of the goals), feasible (in terms of the constraints) solution.

Decision support systems (DSSs) can assist in the problem solving task at several levels. At the basic level, data about system requirements must be accumulated and presented. Historical and current information are presented in reports and are available for inquiry. At a more problem-specific level, DSSs can evaluate the effects of the multiple decisions involved in a solution in terms of goal achievement and requirement satisfaction, enabling the user to operate in a "what-if" mode. At the most problem-specific level, DSSs may be used iteratively to generate and evaluate solutions, proceeding until some confidence may be felt in the global optimality of the best found solution.

Course Scheduling Definitions and Issues

The general scheduling problem may be defined as the assignment of resources to tasks over time. The milieu may be a machine shop or a University, the abstract problem is the same. In the search for the best assignment of resources and times, some sort of model of the processes involved will be employed -- mental, graphical, mathematical, logical or whatever. CHRONOS implements a purely mathematical model of the course-scheduling problem, and applies some powerful heuristic methods to permit the exploration of a great many solutions to the problem at hand.

Model Inputs

The course scheduling task is accomplished by allocation of "resources" to "meetings". A meeting is approximately what is ordinarily called a section, a course teaching unit that meets one or more times per week. The "resources" include an instructor, a group of students, a room, and the meeting time patterns.

Resources

Students. Student scheduling, the final assignment of students to sections of the courses they require, is performed by PASS - the Purdue Academic Scheduling System, after the CHRONOS schedule-construction process is completed. Estimates of student demand or manually determined "keep-together" or "keep-apart" inputs are used to model student influence on the schedule.

Instructors. Staff can be assigned either before or after optimization. Obviously, if staff is not assigned before the process it can have no influence. Pre-assigning staff allows staff requirements and preferences to be considered during schedule construction. The system honors availability (absolute) constraints and conservation of mass/energy; it evaluates preferences for specific hours and days as well as preferences for back-to-back scheduling of sections or one hour breaks between classes and includes them in the criterion function. The building in which an instructor's office is located is given preference in room scheduling.

Rooms. Rooms may be pre-assigned and fixed, but are usually scheduled. The appropriate room type must be specified for each section. CHRONOS considers an adjustable number of candidate rooms and tries to balance room load within equivalent rooms. Rooms may be excluded from consideration either entirely, or for specified times to accommodate events scheduled outside the system. Capacity constraints are applied, as well as the preference for the instructor's office building mentioned above.

Times. The set of days and hours when a section will meet may be preset, or availability constraints may be specified, or CHRONOS may be given total freedom. CHRONOS allocates time according to "time patterns" in which starting times and durations are selected from a restricted set of choices. At Purdue, classes are usually scheduled for 50 minutes, beginning on the half hour, often for 3 days a week, although 75 minute periods on Tuesday and Thursday afternoons are also common. Thoughtful selection of time patterns can greatly reduce the complexity of the schedule construction task and improve the efficiency of the resulting schedule without unduly restricting pedagogical creativity.

Model

The model inputs are combined to produce a choice set for each section in the course schedule. Each element of a choice set consists of a specific choice of a potential room and time pattern for the section. The size of each choice set varies from one (sections with all resource assignments fixed) to many (average sections with no special resource constraints). CHRONOS employs some heuristic devices to limit the proliferation of choices for "easy" sections. The maximum number of candidate rooms per section is parameterized, and an effort is made to spread the load evenly between equal rooms. In version 1.0 of CHRONOS, there is no direct provision for restricting the number of time choices that will be put into the model, so all legal times that meet the section's requirements will be considered.

CHRONOS casts the various inputs to the scheduling problem into the form of a multiple-choice vertex-packing problem. The mathematical formulation is as follows:

Let X = {x_i} represent the set of all time-resource choices, viewed as a vector. Consecutive sequences of x_j form choice sets for each section in the scheduling problem where x_j=1 if its time-resource slot is chosen and 0 otherwise.

(1) Maximize $Z = \Sigma(v_j * x_j) - \Sigma(\Sigma(c_{ij} * x_i * x_j))$

(2) subject to $\Sigma(x_j) = 1$ for each section choice set
(3) and $x_j + x_k <= 1$ for all conflicting choices, j<>k
(4) and x_j in {0,1}

where v_j is the resource value of assigning section choice j,
and c_{ij} is the paired cost of assigning i and j.

Equation (1) is the evaluation function, linear in resource cost for each section choice, with a penalty term for paired interactions. Paired interactions include violation of instructor preference for back-to-back, consecutive, or same-day time patterns. Equation (2) (the multiple-choice constraint) reflects the requirement that exactly one choice must be made for each section. Equation (4) says that each choice is either selected (1) or not (0). Equation (3) precludes any conflicting resource assignments. In the context of the scheduling problem, this means that no room or instructor will be assigned to two sections scheduled with overlapping time periods.

The computer representation of this model is constructed to take advantage of the invariant nature of many of the constraints and interactions involved in computation of the choice-to-choice costs (the quadratic term in Equation 1) and the complete invariance of the value of each particular section choice (the linear term). Paired time pattern interactions and section resource conflicts are computed as part of the model-building process so that they do not have to be computed in the move-evaluation phase of the search process. This means that model-building takes time that is a function of the product of the number of sections and the number of section choices, but move-evaluation proceeds in time that is linear in the number of section choices.

The general outline of the search process is as follows:

1) Get an initial solution and initialize the search
2) Select a set of candidate sections
3) Select the next move
  3.1) Select a candidate for evaluation
  3.2) Apply evaluation function
  3.3) Check candidate status (tabu, feasibility, other, ...)
  3.4) Apply selection rule (best, first improvement, ...)
  3.5) Repeat 3.1 through 3.4 until all moves compared
4) Update solution status if a move found, otherwise restart at a new point
5) Repeat steps 2 through 4 until done.

Details of the search algorithm are provided in Appendix A.

Reports

CHRONOS 1.0, being a prototype system, does not provide user-friendly input procedures, although they are under development. Some rather nice reports are already in existence. They provide both the traditional task-view of the scheduling problem (showing the resources assigned to each section) and a resource-view (showing the daily or weekly schedule for an instructor or room).

Some sample reports are provided in Appendix B.

Appendices

Appendix A - The Search

The CHRONOS search algorithm follows the outline presented in Figure 1 above. Some definitions may be helpful. A *move* consists of negating the choice that had been in the solution for a section and making another choice for the section, in terms of the model, the {0,1} variable that had been 1 becomes 0 and one of the other members of the choice set for the section becomes 1. The *evaluation function* referred to in step 3.2 of figure 1 is just the objective function of the model, with the prospective move included. As mentioned above, even though the function as defined is quadratic in the number of choices, the clever use of data structures to record invariants allows the evaluation of prospective moves in linear computational time.

Search Strategy

The problem of searching for a global optimum in the space defined by our model is complicated. Other than complete enumeration, there seem to be no analytical handles to grab hold of with confidence. Because mathematical precision eludes us, we undertake strategies that give us good feelings about the likelihood that the solution we finally accept is close enough to the best that could ever be found for our purposes. Good feelings, of course, need to be supported by good results, and Mooney's CHRONOS research provides this support as reported in his Purdue PhD thesis ("Tabu Search Heuristics for Resource Scheduling with Course Scheduling Applications", August, 1991).

The literature describes two somewhat conflicting necessities for efficient and effective searching; they are the need to probe many areas of the search space, and on the other hand to focus effort on areas that seem likely to yield improvement by virtue of their closeness to pretty good solutions. The terms diversification and intensification are used for these two strategic necessities.

The simplest way to incorporate diversification and intensification into a strategy is to begin at a random solution and examine all or a sub-set of the possible moves in the neighborhood, picking the best improving move, proceeding until no improvement is possible, then restart from a new random solution. In a physical analogy, we start at a random point and go uphill until we are at the top, then repeat from another random point. This Multi-Start algorithm incurs large computational overhead whenever it has to restart; it also may get stuck at a local optimum that is close to an even better solution because of its single-minded focus on immediate gratification.

Tabu search concepts are included in the CHRONOS search. The Tabu search relaxes the "best improving move" requirement in favor of a "best available move" criterion, combined with availability constraints in the form of list(s) of recent moves that may not be repeated. This intensifies the search in regions that could be expected to contain high-value solutions, while at the same time increasing diversification. The CHRONOS implementation also includes the possibility of an "aspiration" criterion to over-ride the Tabu status in the case of a move that would produce the best solution found to date.

The idea of *dynamic, biased sampling* for candidate move set selection is an original concept developed in the CHRONOS research. Choice sets are selected for move evaluation with a progressively increasing bias toward high-priority choice sets. The priority reflects both the time since a choice set has been sampled and the number of times it has been selected for an exchange. Choice sets which have not been checked for a long time and have had their assignments changed the fewest times are favored for move evaluation. The effect is to increase diversification into areas of potential high-value solutions.

The CHRONOS move selection process employs an oscillating multiplier to account for the cost of hard conflicts in the solution. As presented above, hard conflicts are not directly included in the evaluation function, but the oscillating weight allows hard conflicts to be considered, while reflecting the fact that they are basically incommensurate with the other value and cost factors. The weight factor B varies from 0 to a maximum value which is chosen large enough to overwhelm the influence of the objective function in move evaluation, unless no reduction in hard conflicts can be found. The effect here is to look at high-value, but infeasible, solutions and then try to eliminate the infeasibility -- diversification followed by intensification.

```
Space Mgmt & Acad Sched                          Assignments by Course                          Fri Jul 12 15:07:59 1991
--------------------------------------------------------------------------------------------------------------------------
subj  numb type        title      sec ins bldg  room     days    from        to           Conflicts                   S  H
--------------------------------------------------------------------------------------------------------------------------

I E   200  PRIM   Ind Engr Semina   1 FFL CHME   102 Th         1:30 pm  2:20 pm

I E   231  LAB    Systems Analysi   1 CJM GRIS   120 M          2:30 pm  3:20 pm
                                    2 CJM GRIS   120 M          1:30 pm  2:20 pm
                                    3 CJM GRIS   120 M          3:30 pm  4:20 pm
                                    4 CJM GRIS   120 W          2:30 pm  3:20 pm
                                    5 CJM GRIS   120 W          4:30 pm  5:20 pm
                                    6 CJM GRIS   120 W          1:30 pm  2:20 pm
                                    7 CJM GRIS   120 F          3:30 pm  4:20 pm
                                    8 CJM GRIS   120 F          4:30 pm  5:20 pm

I E   231  PRIM   Systems Analysi   1 MAF ME     161 TTh        9:30 am 10:20 am

I E   231  SEC    Systems Analysi   1 CJM GRIS   180 M          7:30 am  8:20 am
                                    2 CJM GRIS   180 W          7:30 am  8:20 am

I E   300  PRIM   Honors Program    1 MDC MGL   1210 M          4:30 pm  5:20 pm

I E   330  PRIM   Statistical Con   1 ALS EE     270 MWF       11:30 am 12:20 pm

I E   335  PRIM   Operations Rese   1 RLR MGL   1310 MWF        3:30 pm  4:20 pm
                                    2 RLR MGL   1310 MWF        2:30 pm  3:20 pm

I E   336  PRIM   Operations Rese   1 JDP EE     170 MWF       12:30 pm  1:20 pm

I E   343  PRIM   Engineering Cos   1     WTHR   200 MWF        7:30 am  8:20 am
                                    2     ME     161 MWF        3:30 pm  4:20 pm

I E   345  PRIM   Engr Economic D   1 RU  EE     270 MWF        1:30 pm  2:20 pm

I E   366  PRIM   Elements of Pro   1 JRD ME     161 MWF        4:30 pm  5:20 pm

I E   370  PRIM   Mfg Processes I   1 JIK MGL   1310 MWF       10:30 am 11:20 am
                                    2 CC  MGL   1310 MWF        1:30 pm  2:20 pm

I E   383  PRIM   Integrated Prod   1 SYN SMTH   108 MWF        2:30 pm  3:20 pm

I E   386  LAB    Work Analysis &   1     GRIS   155      ** NO TIME ASSIGNED **

I E   386  PRIM   Work Analysis &   1 JWR GRIS   180 TTh       10:30 am 11:20 am

I E   431  PRIM   Systems Analysi   1 JJT WTHR   172 TTh        2:30 pm  3:45 pm

I E   470  LAB    Mfg Processes I   1     MGL   1308 M         11:30 am  1:20 pm
                                    2     MGL   1308 W         11:30 am  1:20 pm
                                    3     MGL   1308 F         11:30 am  1:20 pm

I E   470  PRIM   Mfg Processes I   1 JIK MGL   1310 MF         9:30 am 10:20 am

I E   474  PRIM   Industrial Cont   1 SC  SMTH   108 MWF        3:30 pm  4:20 pm

I E   477A PRIM   Work Methods Me   1 JRD SMTH   108 MW         7:30 am  8:20 am

I E   477A SEC    Work Methods Me   1     GRIS   155 Th         2:30 pm  3:20 pm
                                    2     GRIS   155 Th         4:30 pm  5:20 pm
                                    3     GRIS   155 Th         3:30 pm  4:20 pm
                                    4     GRIS   155 F          1:30 pm  2:20 pm
                                    5     GRIS   155 F          3:30 pm  4:20 pm
                                    6     GRIS   155 F          4:30 pm  5:20 pm
                                    7     GRIS   155 F          2:30 pm  3:20 pm

I E   477B PRIM   Work Methods Me   1     MGL   1310 MWF        7:30 am  8:20 am

I E   484  LAB    Integrated Prod   1     GRIS   250      ** NO TIME ASSIGNED **

I E   484  PRIM   Integrated Prod   1 YY  GRIS   180 TTh        9:30 am 10:20 am

I E   486  LAB    Work Analysis &   1 REE GRIS   155      ** NO TIME ASSIGNED **

I E   486  PRIM   Work Analysis &   1 REE POTR   105 TTh       10:30 am 11:20 am

I E   495  PRIM   Indust Practice   1 JWR MGL   1210 WF         4:30 pm  5:20 pm
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           7:30 am     8:30        9:30        10:30       11:30       12:30 pm    1:30        2:30        3:30        4:30        5:30        6:30        7:30        8:30        9:30        10:30
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|BCHM  100 |           (BCHM562  ) (BCHM561  ) (I E 330  ) <BCHM587  > (I E 230  ) (    NUR 382 Prim  01   ) (    NUR 380 Prim  01   )
|BRNG 1184 |                       (NUR 102  ) (IET 466  )             (E E 301  )                         (NUCL600 Prim 01)
|CHME  302 (HSS 290  ) (CHE 450  ) (CHE 378  ) (I E 343  ) (POL 101  ) (CHE 211  ) (CHE 348  ) (C E 340  ) (POL 141  ) (I E 343  )
|CIVL 1144 [C E 273  ] [C E 371  ] [C E 296  ] [C E 296  ] [C E 273  ] [C E 273  ] [C E 270  ] (PE  200  ) (POL 120  ) [C E 273  ]
|CIVL 1252 (EDCI310  ) [C E 426  ] [C E 220  ] [C E 473  ] [C E 469  ] [C E 474  ] (EDCI300  )             (EST 360  )
|CL50  224 <SOC 100  > (MA  162  ) [CHM 205  ] (PSY 444  ) (MA  162  ) (COM 318  ) (HIST162  ) (MA  162  ) (COM 435 Prim  )
|EE    129 (ECON210  ) (MGMT200  ) (EDPA400  ) (MA  162  ) (FOR 103  ) (ECON210  ) (MGMT200  ) (FOR 303  ) (MGMT200 Prim  )
|EE    170 [E E 206  ] (TB  116  ) (C E 301  ) [E E 362  ] [E E 200  ] (I E 330  ) (POL 130 Prim  )        (HIST303  ) (RECR100  )
|EE    270 (CSR 404  ) (HIST162  ) (E E 201  ) (HIST306  ) (C E 302  )             (E E 202  ) (E E 201  ) (E E 206  ) (E E 201  )
|HORT  117 (BC  100  ) [L A 220  ] [L A 116  ] [HORT201  ] [HORT227  ] (TB  170  ) [HORT423  ] (E E 300  ) (E E 301  )
|LILY 1160 |           (SOC 100  ) (GEOS104  ) (HIST100  ) [BIOL240  ] (HIST161  ) [BIOL221  ] (COM 300  ) <BIOL241  >
|LILY G126 |           (C E 360  ) (PSY 300  ) <AGRY320  > (CHE 320  ) (AGRY231  )             <AGRY255  >
|MATH  175 |           (SOC 220  ) (C S 130  ) (OBHR300  ) [A&D 227  ] (A&D 205  )                         (A&D 286  ) [C S 6005 ]
|ME    161 <M E 200  > <M E 200  > <M E 270  > <M E 200  > <M E 270  > <M E 200  > <M E 270  > <M E 206  > (MGMT303  )
|ME    261 <M E 316  > <M E 274  > <M E 310  > (E E 400  ) <M E 376  > <M E 274  > <M E 362  > <M E 316  > <M E 460  > [A&AE453  ]
|MSEE B012 [MSE 230  ] (CPT 175E )             [CPT 175B ] <CPT 302  >             [MSE 230  ]             [    MSE 600 Prim  01   ]
|MTHW  210 |           (HIST304  )                         [MUS 250  ] (HIST104  ) (GEOS100  ) (COM 203  ) (PSY 120  ) (HIST372  )
|PHYS  112 (PSY 120  ) [PHYS201  ] (PHIL120  ) [PHYS201  ] [PHYS210  ] (ANTH100  ) (CSR 200  ) [PHYS342  ] (GEOS115 Prim  )
|PHYS  114 (OBHR330  ) (GEOS120  ) [PHYS163  ] [PHYS210  ] [PHYS218  ] (BIOL226  ) [PHYS220  ] [PHYS140  ] (ATMS230 Prim  )
|PHYS  203 |                       [A&D 404  ] (CHE 205  ) (PSY 577  )             (TB  200  ) (HIST161  ) (EDPS260 Prim  )
|PHYS  223 |           (E E 202  ) (I E 474  ) (E E 206  ) (PE  253  )             (EDCI314 Prim  )        [    PHYS605 Prim  01   ]
|RHPH  172 [PHPR460  ] [PCTX442  ] [MDCH422  ] [MDCH565  ] [PHPR470  ] [IPPH553  ] [PCTX440  ] [MDCH566  ] [PHPR503  ] (I E 266  )
|SMTH  108 (I E 477A ) <AGRY375  > (ENTM100  ) (PSY 300  ) (PSY 240  ) (TG  100  ) <AMSC301  > (AUSL227  ) (HIST104  ) (GEOS111  )
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** 12000 Minutes = 200  (60 minute ) hours scheduled per week. **
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|PHYS   114 |                       (C S 148   ) [PHYS152   ] [PHYS152   ] [PHYS152   ] [PHYS152   ] [PHYS152   ] [PHYS152   ]
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parmentr@oasis.cc.purdue.edu, parmentr3915b, sched@mace.cc.purdue.edu, Fri Nov 8 10:58:30 1991, 4 pages printed

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37th Annual College and University
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W1-3

Centralized Budget Preparation in a Decentralized Environment

Jackie Zucker
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University of Miami

CENTRALIZED BUDGET PREPARATION IN A DECENTRALIZED ENVIRONMENT

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Introduction

At the University of Miami, budget control and management is a centralized function of the Budget Office at the Coral Gables campus, but the workload of budget preparation sits in the hands of over two hundred departmental units. These departments must get approval not only by the department chairman, but must also be approved at the divisional and school/dean levels. At each of these levels, the budgets of the lower units must be consolidated for management review and approval. Some of these departments are so large that they are budgeted at a sub-department level. At the Medical campus, budget management responsibilities lie with the central Medical Budget Office.

The Applications Systems Development group of Information Resources has recently completed its initial long range information systems plan that encompassed the development of systems for all central administrative functions. Currently, the focus is to reengineer these central processes to provide tighter integration between systems and to decentralize the functions to the departmental units. One of these decentralized systems is the Budget Preparation System.

Background

The idea for a budget preparation system originated due to difficulties the Medical campus was having compiling the budget efficiently and on a timely basis. Departments on the other campuses are much less complex and deal with a smaller number of accounts and employees. Also, these departments are so small that most of the budgeting is done at the dean/school level. The accounts of the medical school come from a variety of fund sources including: grants, contracts, gifts, and medical professional services. On the other hand, the other campuses primarily budget expenses based on an allocation. Since the departments at the other campuses are less complex, they had little problem completing their budgets using PC spreadsheet software.

Another problem that all campuses faced was the difficulty in obtaining the initial information required to complete a budget such as personnel and financial records. At the time, the Human Resources System and the Financial Records System were strictly centralized systems and the departmental administrators were forced to rely on reports that were usually a month old by the time they received them. The Department of Medicine had so much information to compile that the process of preparing the budget brought their administrative office to a standstill for five months.

The medical school departments were limited in their ability to prepare their budgets due to outdated computer equipment and lack of technical guidance. As a result, several departments began hiring programmers and tried to develop specialized systems on their own. A major shortcoming of these systems was the inability to share data with other university systems. Each of these systems produced different reports and did not follow the same methods. Therefore it was very difficult for the central Medical Budget office to consolidate the departmental budgets into a campus-wide budget. The central Medical Budget office would have spreadsheets not only piled up on their desks, but covering the floors and hallways. Even with newer hardware and a programming staff, some departments found the PC solution to be to slow and cumbersome. One department using a spreadsheet program was forced to wait several hours for one recalculation.

The central medical budget office prepared a budget "bible" that was intended to provide the rules for budget preparation on that campus. It was hard for them to verify if the departments were really following the policies since reports were generated in many different formats. These policies include limitations on salary increases and use of fringe benefit rates. The large number of departments and the lack of a central communication mechanism made if difficult to communicate updates in budget policies.

To further complicate the consolidation process, there was no integration of data or communication between the medical school departments. It was very common to have budgetary transfers from an account in one department to an account in another. There was no method to verify that all transfers were accounted for by both departments or that both departments agreed that this transfer should take place. A similar problem was when an employee was budgeted from an account outside of their department. This required an archaic process of gathering signatures that no one had time to verify.

With strong support from the Assistant Vice President for Medical Finance and Budget,, an appeal from the Assistant Chairman of the Department of Medicine to the Sr. Vice President for Business and Finance lead to recognition of the need for a standard computerized solution to the budget preparation problems. The University had the choice of developing a system or continue to have individual departments find their own solution by hiring individual programmers and purchasing additional computer hardware. The decision was for Information Resources to analyze the problem and develop a computerized solution.

System Development

Information Resources began the project towards the end of August 1990 with the goal of implementing a standard budget preparation tool by January 1, 1991. This date was critical since this was when the budgeting process began for the next fiscal year. Among others, the Department of Medicine needed to be assured that there would be a system to use or they would begin obtaining equipment and developing a system on their own.

User interviews were conducted on all campuses with over thirty departments. The medical campus was very interested in the development of a standard solution, whereas the other campuses were adamant they maintain the status quo. It was decided that in this time frame a system would be developed exclusively for the medical campus. Despite this decision, functionality issues for all campuses were maintained throughout the design and development phases of the project.

The interviews at the medical campus identified several problems. At that time, the reports they needed to begin their budget were routed through the central offices. From there they were distributed to the appropriate campuses, and finally to the departments. This process led to the reports becoming outdated before ever arriving at the department. Therefore, the system would require all of the initial information on-line from the beginning to eliminate the need for these reports.

After analyzing the problems with the current process and the needs identified by the users, three alternatives were identified. The first alternative of maintaining the status quo was quickly dismissed. A standardized PC system was deemed unacceptable due to the hardware limitation of many departments, speed of recalculations, security issues, and consolidation of the budget by the central offices. The last alternative was to develop a mainframe system that would provide the functionality required at both the departmental and all other organizational levels. The mainframe system was chosen since it offered the departmental users the data and processing they required as well as a mechanism for centralized control and consolidation.

Administrators from the Department of Medicine and the Medical Budget Office were identified as key users and participated in the functional design of the system. The Department of Medicine represented the most complex department in the University and could speak on behalf of the other departments. The Medical Budget Office could aid in defining the policies, maintaining the appropriate controls, and set criteria for the consolidation of information into management views.

The management views included such information as viewing an account with all of its associated detail, viewing account balances by organizational level and by fund, as well as an overall plan of operations by organizational level. Managerial views of employee data included percentage increases of salaries by employee, salary pool percentages by organizational level, and the ability to view employee salaries by account and fund.

After several discussions with the key users, it was determined that the system requirements be broken into five categories for more detailed analysis. These five areas were: 1) the initial information requirements for budget preparation, 2) the processing requirements at the various organizational levels, 3) specific requirements at the departmental level, 4) the security, approval, and consolidation requirements of the central office, and 5) the data flow to other systems after completion of the budget.

The initial information requirements were determined to lie in three places. The chart of accounts and financial data were required from the financial records system. Also, prior year budget amounts were needed from the budget file. Finally and of prime importance, was the need for personnel/payroll information from the Human Resources System. This data would save countless hours by eliminating the need to verify salaries, and automating the work involved in consolidating the information for salary pool calculations. Since all of this information resided on the mainframe, it could be easily ported to the budget preparation system. Standard budget policy was to use information as of calendar year end. Since point-in-time data was required it was decided to extract the information from these systems instead of directly integrating with them.

Processing requirements at the various organizational levels was basically the same. At the division and dean/school levels, users require immediate consolidation of the lower level budgets. Since immediate updating at all levels is required, all updates must roll up to higher levels in real time. Efficiency in database design and program specifications were of utmost importance due to this multi-level on-line recalculation process.

The needs for processing at the departmental level were simple. They wanted to update personnel budget information as well as operating and capital budget amounts. Recalculation time and ease of data entry were of prime importance. They needed the ability to update their chart of accounts with TBA accounts, and also create TBA positions for future employees. They also required automatic calculation of employee fringe benefits and a method to manage salary pool requirements. Finally, they desired several different on-line management views of the budget as well as supporting reports.

The central medical budget office was primarily concerned with the security, approval, and consolidation of the information. It was very important that the departmental users could only access data from their department. They needed the ability to use other department's accounts and to transfer funds between departments, but should not be permitted to view the account detail or employee salaries from another department. The central office also wanted the ability to "shut off" a department from further updating of their budgets once they were approved to insure that unauthorized changes did not enter the budget. Finally, they needed to have a real-time consolidated view of the information. The same managerial views provided to the departments were required at the school/dean level, as well as the division level. Therefore updates to a department's budget had to be reflected at all levels instantaneously. This would eliminate any need to manually consolidate the budget for any level.

Both the departmental and the central budget office administrators were interested in having the data flow directly into the Budget File, the Financial Records System, and the Human Resources System for the next fiscal year. Upon final approval at all levels, the information would be extracted from the budget preparation system and loaded into the appropriate systems. This would eliminate the need to fill out forms based on reports at the departmental and central levels.

Database design was completed by the end of October, leaving only two months for data conversion, programming, testing, and documentation. Several problems were encountered in data conversion since the data in the other systems was not as easily extracted as expected. Although the required fields existed in the other system's databases, fields not important to the central offices were often overlooked or entered incorrectly. Therefore, significant time was spent in researching specific problems associated with the conversion.

Implementation

The implementation phase of the system began January 1, 1991 and training started immediately. A few of the larger departments were chosen to use the system for the first year so that the bugs could be worked out. Once these departments were trained and began using the system, word spread throughout the medical campus that there was a system available to complete budget preparation at no expense. Soon the majority of the medical school departments asked to use the system. Another series of training sessions were started as more users were recruited.

Some problems were encountered with departments who did not already have a connection to the mainframe. Due to the time frame, these departments had to rely on modem connections to gain access to the system. Another problem was the report distribution process. There was no printing facility at the medical campus, so a high-speed line printer was purchased and installed at the Medical Budget Office. Reports were submitted on-line upon user request and were printed in this facility. Since most of the information they needed was available on-line, printouts were needed primarily for final budget review.

A review of the system shows that an annual cost savings of approximately $102,000 in personnel costs will be realized by the medical campus as well as intangible cost savings of $44,000. Efficiency in the departmental units will allow other tasks to be performed during the budget preparation period. Also, all time previously spent on consolidation of budgets at higher levels will result in substantial time savings.

Future Plans

With the overwhelming success at the Medical campus, there was an impetus to expand the system to be used on all campuses as "the" budget preparation tool for the University. This eliminates the need for any uploads into the old flat file system and provides a strong foundation for the development of a year-round budget management tool, the Budget Management System.

The Budget Management System will maintain the permanent budget base for all university accounts and employees. The user interface will be virtually identical to the Budget Preparation System thereby avoiding a retraining effort. Also, this will provide an on-line view of the permanent budget to the central budget office and the various departments.

Downloads of the data can easily be provided to facilitate various needs. The central budget office can use the information to aid in forecasting future budgeting needs, employee salary pools, fringe benefit rates, etc. The departmental users can use the downloaded information to upload the data into their PC based expenditure control and financial management systems.

Furthermore, the budget management system will provide for on-line interfaces with other financial systems. This system will be just a piece in the puzzle of an overall decentralized view of all University financial data. This "Departmental View" will encompass functions from Budget Preparation/Management, Human Resources/Personnel, Financial Records, Purchasing, and Document Processing/Approvals.

The Document Processing feature of the system will provide for direct entry of "documents" by departments into the various systems. The approval feature of Document Processing will electronically send the document to all individuals requiring an approval of the document. Once all of the electronic signatures are gathered, the document will be immediately processed in the appropriate system.

For example, a mid-year budget revision would be entered by a departmental user as an electronic document. This "form" will be sent to the Account Signatory, the Departmental Financial Supervisor, the Controller's Office, and ultimately the Budget Office. Once approved by all of these areas, the revision would update the general ledger and the budget management system. The ultimate goal of this facility is to convert all University forms into electronic documents.

The Budget Preparation System has provided a strong foundation for the development and acceptance of the decentralized concept. The distribution of data entry from the central office to the departmental offices has reduced errors, reduced lag time, and better educated the departmental users on central office policies and standards.

37th Annual College and University
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W1-4
Survey of Administrative Data Requirements for Instructional Effectiveness

John Biddle
University of Louisville

SURVEY OF ADMINISTRATIVE DATA REQUIREMENTS FOR INSTRUCTIONAL EFFECTIVENESS

by

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I. INTRODUCTION

Administrative offices in colleges and universities have made significant strides in the automation of most of their reporting and data storage requirements. In fact, most of these systems have been converted multiple times (From tab cards on Unit Record Equipment to cards, to magnetic tape and/or disk on batch systems, to magnetic disk storage and on-line systems). Some of these systems have even been converted to use optical storage technology recently. Administrative computing has certainly come a long way from its meager beginning, in the financial records area in most institutions, to the present where every administrative area has at least one system running, usually on the institution's mainframe, with immediate access to the records in the database. In many cases, the data is now downloaded to a workstation in a worker's office. In most institutions, these systems are now indispensable in assisting the administrative office personnel in completion of their required assignments.

But what about the academic side of the college coin? While some administrators (a small percentage) would like to believe their institution is there to provide them with employment, the fact still remains that institutions of higher education exist for one main purpose;--THAT IS THE INSTRUCTION OF STUDENTS. Certainly there are peripheral activities such as research and service, (and even intercollegiate athletics) but these activities could not survive without the instructional component. The instructional component would certainly suffer without the research component.

Why then, is it that institutions have been slow in providing up-to-date automated applications and data access for the instructional component? I am not referring here to support for classroom instruction such as programming languages and such, but to support from administrative systems for the faculty. There are a myriad answers to this question. Some of them are: Administrators have their act together, they know what they want, while faculty think they are unique and each faculty member wants a system tailored to them. Administrators have control of the money so they can allocate it for their own systems first. Faculty don't know what they want. Faculty are not responsible when it comes to security, if I let them have access to my data they'll "screw it" up. Faculty don't need the information on-line like I do, they can wait for a hard copy report. State and federal laws restrict on-line access to them so they have to receive it in hard copy. It's too much trouble and will cost too much to let every faculty member have on-line access to the information we provide them in hard copy.

I contend the above arguments are being used as a cover for not producing systems that are being requested from the academic component. If what an institution of higher education is all about is the education of its clientele, the educator should be provided with the latest tools available and the red tape associated with the teaching/research process should be reduced to a minimum. What red tape you ask? Consider the instructor who has 200 or more students a term. Obviously, the class list data is in electronic form but the instructor receives it in hard copy. By the time the class list arrives in the instructor's mail box it is out of date, even if it is produced daily. The problem is really compounded here. The instructor wants to maintain the class records in electronic form, maybe on the same system the Student Records System is on. In this instance, the instructor receives the class list in hard copy and has to rekey the information back into the same system it came from. Another scenario is that the instructor has a workstation with a connection to the mainframe and wants to keep the electronic grade book on the workstation. The time wasted in rekeying the grade book information in either case is valuable time that could have been spent preparing for the class or doing some other productive activity. A third example is reporting attendance and progress of athletes. NCAA requires the institution to monitor closely the attendance and progress of intercollegiate athletes. I receive class list at varying intervals throughout each term. Hopefully, the first one arrives prior to the first day of class. If an athlete is not attending one of my classes, I have no way of knowing if the athlete has dropped the course or is just not coming to class. Not having access to an on-line roster, I have to certify the athlete as absent and usually with a failing grade when in fact the athlete is no longer enrolled in the class. Many additional examples that could be cited.

II. THE STUDY

In an attempt to discover what administrative data and support from administrative systems faculty would like to have on-line, I conducted a national survey of faculty by accessing several electronic discussion groups on BITNET and INTERNET. These discussion groups spanned several academic disciplines. Initially, CUMREC-L and CWIS-L list server members were asked to provide me with at least two faculty members I could send a survey to. While the response was not what I thought it was going to be, I did receive several names and node ID's. Each person identified with an electronic mail address was sent a copy of the questionnaire electronically. To assist in obtaining additional participation, I requested the person to forward the survey to additional colleagues and to provide me with additional discussion group names to contact. This process yielded several additional discussion groups. I signed on to them and distributed the questionnaire to the discussion group members. These groups ranged from Anthropology to History, to Physical Therapy, to several sciences.

The instrument I created used a Likert scale of "1 = I don't need it" to "5 = I need it desperately" for the responses. Each question involved some form of data or information that was normally available in hard copy. The questions were structured so that the response determined the respondent's view concerning on-line access to the data or information. Respondents were encouraged to add additional items to the list and to "score" them. Several respondents did add items to the list.[1]

The questionnaire was distributed to 10 discussion groups nation-wide. At least two of these are international and I have received responses from as far away as the Middle East.

A. BIAS IN THE SAMPLE

There is an obvious bias in the sample used in this study. Since the survey was sent only to people who were members of an electronic discussion group, I was contacting people who are at least semi-computer literate (no offense intended) and people who are familiar with on-line access to information. This then excludes a vast number of faculty who may have very different views to the questions and who for one reason or another do not have access to

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[1] See Appendix for the list of additional items.

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BITNET or INTERNET, to a workstation or a terminal, or who are not a member of one of the discussion groups I chose to use.

B. ACADEMIC QUESTIONNAIRE

After informal discussions with faculty at The University of Louisville and other institutions, it became obvious to me that many of these faculty had a requirement for on-line access (inquiry-only and/or update) to the administrative systems to support their academic activities. The questions for this study were developed from the comments made during these discussions. As you will see, the questionnaire was open-ended and respondents were encouraged to add additional items.

A copy of the faculty questionnaire used in this study has been reproduced in the Appendix.

C. ADMINISTRATIVE QUESTIONNAIRE

After receiving several responses from colleagues across the country, it became obvious the study should be expanded to include the administrative data suppliers. Another questionnaire has been created and distributed to the members of CUMREC-L and CWIS-L. This questionnaire addressed the same topics as the academic questionnaire but asks for a different response. Analysis of the responses to the administrative questionnaire will be reported in another paper.

III. ANALYSIS OF THE DATA

Given the built in bias of electronic access, inferential statistics are an inappropriate tool to use for analysis. It could possibly be argued that the faculty using electronic communications is a mirror image of the total faculty population, but I believe that premise is difficult to defend without providing the "non-electronic" faculty with an opportunity to respond to the questionnaire. The data will be analyzed with descriptive statistics only. 570 responses were received.

The results of this study are as follows:

A. DATA NEEDS (Ability to Perform On-Line Inquiry only)

In the area of student data 53% of the respondents selected response 5 (1 = I don't need it. to 5 = I need it desperately) when asked about data concerning their advisees. More notably, 82% selected response 3, 4 or 5. While 64% responded with a 5 concerning on-line class roster data only 13% selected response 1 or 2. 45% responded 5 to the need for advisee degree audit information. This percentage increases to 79% when 3, 4, and 5 are considered. The lowest in this category was the need for major and minor information. Even here, 26% stated they required this information. This was still the highest percentage of any of the five responses and over half (56%) responded with one of the top 3 responses. FIGURE 1[2] shows the relative ranking of the responses to the need for Student Records data. The mean response for the first 3 items was 4, while the mean for the fourth item was 3.

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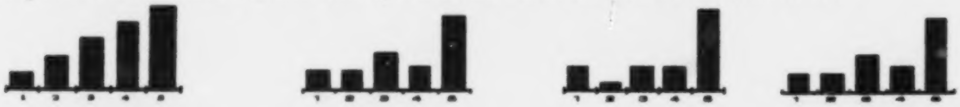
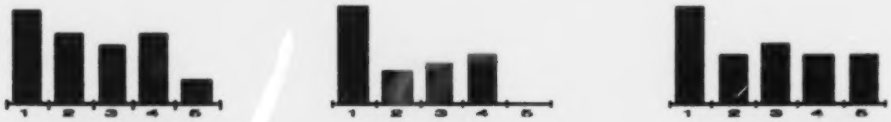
[2] All graphs in this paper depict the relative rate of response to each question. The number of responses by category has been omitted to make the graphs more readable. These data are presented in tabular form in the Appendix.



a. Advisee assigned to me b. Progress toward a degree c. Class rosters d. Majors and minors in my department

FIGURE 1
Data Needs from Student Records System

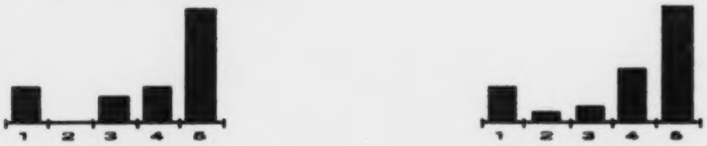
In the area of Alumni and Development records, the expressed needs are not as pressing. On all three questions, response 1 (I don't need it) was the highest percentage response. The remaining responses were distributed almost evenly between 2, 3, and 4 with the mean of 3 on graduates from the program and 2 and 3 respectively on donors and potential donors to the program. The cumulative percentage for responses 1 and 2 was 50% or above on all three questions. FIGURE 2 graphically represents these data. It is worth noting that no one selected response 5 concerning donor information.



a. Graduates from my department b. Donors to programs c. Potential donors

FIGURE 2
Data Needs from Alumni and Development Records

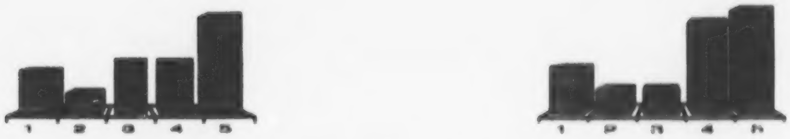
Inquiry access to financial data also ran quite high. Almost three quarters of the respondents express a high or desperate need for inquiry into account balances and transactions against accounts they had signature authority over. Less than 20% of those responding had little or no desire to be able to inquire into their accounts. FIGURE 3 shows the response distribution for inquiry into financial data.



a. Account balances b. Recent account transactions

FIGURE 3
Data Needs from Financial Records System

As can be seen in FIGURE 4, somewhat over one third (36%) have a desperate need to have inquiry access to the open purchase requisitions and to the status of purchase orders. This percentage jumps to 76% when the top three response categories are considered.



a. Status of purchase requisitions b. Status of Purchase Orders

FIGURE 4
Data Needs from Purchasing System Records

There is little requirement for inquiry into student data in the Personnel System. Less than 25% of the people needed the information desperately and only an additional 7% checked response 4. If one considers the top 3 response (3, 4, and 5) the percentage goes to 53% with 23% selecting response 3. These data are depicted in FIGURE 5.

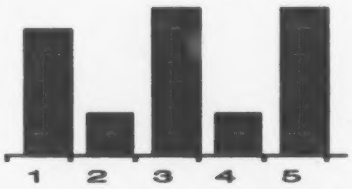
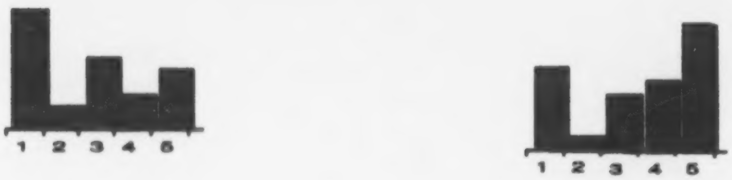


FIGURE 5
Data Needs from Personnel Records

B. ON-LINE INQUIRY AND UPDATE NEEDS

On-line inquiry is one type of access that could be provided. The above discussion concerns that type. Another, possibly more touchy issue, is the ability to access and to update data in a database. Such access requires additional security measures and more stringent monitoring of activity. This is especially true if students have access to the computer the administrative systems and data reside on. Be this as it may, there are still certain administrative systems' data elements faculty could access and update without compromising the integrity of the files. In particular, changes in major and minor, preregistration and registration course requests, student demographic data, and advising information to name a few.

The questionnaire requested needs in the area of update to majors and minors files and to those of advisees. As can be seen from FIGURE 6, updating the files of departmental majors and minors is not high on the list with a mean of 3. However, it appears it is more important to the faculty to be able to update electronically the records of their advisees. While the mean on this question was still only a 3, 58% listed this as a 4 or 5 and almost three fourth of the responses were 3, 4, or 5.



a. Majors' and minors' files

b. Advisees' records

FIGURE 6
Inquiry & Update Needs for Student Records

While only 8% of the respondents had a deep desire to enter purchase requisitions or to update existing purchase requisitions electronically, 67% responded with a 3, 4, or 5. See FIGURE 7 for the results of this question.

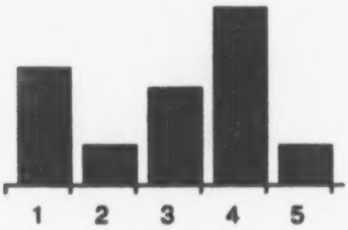


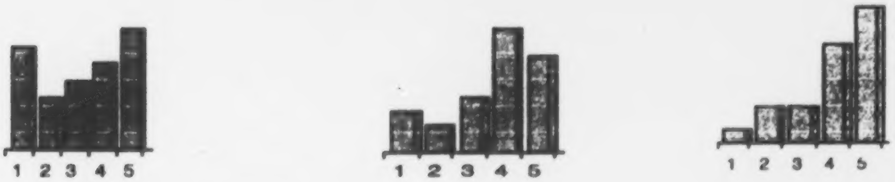
FIGURE 7
Inquiry or update a purchase requisition on-line

C. APPLICATIONS SOFTWARE NEEDS

Another area of administrative support for academic effectiveness is the area of providing "administrative software" and transference of administrative data to faculty accounts. Three potential items were listed in the questionnaire. They were: provisions for an electronic grade book, ability to enter final grades into an electronic grade sheet, and the ability to download class lists to an account on the same or a different computer. There are obviously many more items that could have been included in this list. Additional items, listed in the appendix, that were provided by the respondents clearly indicate this fact.

The requirement for an electronic grade book received mixed reactions with a mean response of 3. The number of persons desperately needing an electronic grade book was only 28% but that was the highest percentage of any response. However, less than two thirds chose 3, 4, or 5. Some of the respondents suggested that they placed different weights on tests, quizzes, homework, and labs and wondered if it would be possible to create a generic enough grade book for everyone to use. Had this question been explained in more detail, the mean response might have been significantly higher. When asked if reporting final grades electronically was something that would be useful, 62% responded with either a 4 or a 5 and an additional 15% selected response 3. Therefore almost 4 out of 5 faculty felt they would benefit from being able to transmit their final grades on-line to the records office.

Having a class list transferred to a faculty account or downloaded to a workstation was selected as desperately needed by 41% of the respondents. Only 4% stated they had no need for receiving class lists electronically. FIGURE 8 summarizes these three questions.



1. Electronic Grade book

2. Electronic grade reporting

3. Down-loading of class list

FIGURE 8
Applications Software Needs

IV. CONCLUSION

Responses to the various items of the questionnaire reflect the administrative and academic makeup of the various institutions. That is, some institutions have a professional staff of academic advisors and the faculty play no part in the advising process. In those instances the respondents selected response 1. On the other hand, where the faculty member was heavily involved in the advising process a 3, 4 or 5 was selected. This same theme carried through the other questions. Faculty with no research involvement or with research projects that do not involve a separate financial account did not need the information. Faculty conducting research (usually in one of the sciences) with grants for equipment and/or assistants were very interested in up to the minute financial accounting.

Some of the participants in this study indicated their institution had little or no control of the financial and personnel records. They indicated these data were under the control of a state agency which provided the information down to the individual institutions.

Of the three software items listed, down-loading the class lists to an account or a workstation was rated as needed the most. That correlates highly with the responses to the student data question concerning class rosters.

If one combines the responses to the access questions regarding the Student Records System data into one graph, it becomes very obvious the majority of the respondents desperately want on-line access to that data.

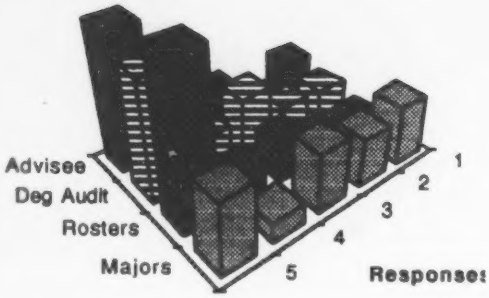


FIGURE 9
Cumulative Responses to Need for Inquiry to Student Data

In the areas of Alumni and Development, there is less of a desire for on-line access. A majority of the respondents have little or no interest in donor information. No one responded with a "I need it desperately" response. Alumni records access were almost evenly divided among the five response categories with 1 more prevalent than 5. Some responded that these data were considered confidential by the institution's administration.

Personnel records of student assistants also spread the responses across the board but in a little different manner. Respondents chose either a 1, 3, or 5 which indicates they either really needed the information or really did not need the information or did not care strongly one way or the other. Very few were lukewarm on either side. One could conclude from this that those responding "1" either had no student assistants or student assistants were assigned to them and they had no control over the process, while those responding with a "3" or a "5" did have control over their student assistant selection and pay. I would assume, but can not verify at this time, that those responding "5" were people with research grants who were using some of those funds to employ student assistants.

One conclusion that can be reached from this study is that a majority of the respondents are interested in receiving data on-line instead of, or in addition to, hard copy. In particular, data concerning students, such as: class rosters, advisee records, progress toward a degree, and electronic filing of final grades top the list. A second conclusion is that the ability to access financial accounting data and systems so that queries can be made as to the status of various accounts, purchase requisitions, and purchase orders is also highly desirable. A third conclusion is that there is less desire to have access to alumni, donor, and personnel records.

Based upon the results of this study, those persons charged with the responsibility for control of access to administrative data should:

1. Reconsider policies of excluding faculty from on-line access to student records in instances where the student record is or can be obtained in hard copy.

2. Provide researchers with on-line inquiry access to those financial records pertaining to accounts the researcher has signatory authority for.

3. Provide faculty, with financial account signatory authority, the ability to initiate and enter purchase requisition information on-line and to be able to monitor the purchasing process on-line.

Faculty and academic administrators have the ability to be as competent as administrative office personnel when dealing with on-line systems if they are given the proper instructions.

On-line inquiry and on-line update of the types considered in this study will certainly cause many institutions to rethink current policies and procedures. Additional security may need to be installed and more extensive transaction logs, perhaps by individual, may need to be created to assist in monitoring and controlling the process.

The results of this survey differ from a recent survey conducted by a University of Illinois, Chicago Senate Committee on Academic Computing Services. That survey, conducted in the Spring 1991, was circulated throughout the UIC faculty as part of a publication from the computer center. Approximately 60% of the respondents to the survey were regular computer users. Only 2% of the respondents reported they never used a computer. While the UIC survey did not ask the same questions as this study, it is noteworthy to report some of the findings. The four services rated most useful were: e-mail, compiling data or statistics, Library on-line catalog, and access to BITNET. It is reported that there was a lack of agreement as to what needs the faculty felt were desperately needed and which ones they had little desire to receive on-line. Those findings differ markedly from some of the results of the study being reported here.

The responses from the administrative data provider may be more biased than those of the faculty. It would appear from the responses received to date that only those institutions providing access to data by faculty are responding. One could assume the rest of the institutions represented in the electronic discussion groups surveyed do not provide faculty access to administrative data and therefore did not respond to the survey. These initial results seen to indicate that some progress is being made to provide some if not all of the access requested by the faculty. This is good news since such access will certainly reduce the time spent by faculty on administrative data tasks. It will also relieve the anxiety of researchers with funded research, particularly at times when the account balances are approaching zero or the spending deadline is approaching.

It would be very interesting to see what the reactions to both the administrative and academic questionnaires are from persons not members of the discussion groups contacted. In particular, what would be the reactions of faculty that are not using electronic techniques at present? If they thought it was possible to have an electronic grade book, would they want one? Even more to the point, if they knew they could communicate with their colleagues across campus and around the world, would they want a workstation in their office? These final questions must be reserved for other studies.

APPENDICES

Appendix 1
The Academic Questionnaire

The following is the questionnaire sent electronically to faculty:

Colleague:

I am surveying a random sample of the academic community to determine what administrative computer systems would be beneficial to you to be able to perform your academic tasks easier, more efficiently, or more effectively.

As you know, most, if not all, of the administrative data processing has been computerized in one form or another. Many of these computerized data bases contain information that would be valuable for the academic community to have available without requesting hard copy reports from various administrative offices. There are also certain "academic administrative" functions that could be automated to make the life of the academician easier. One small example is an on-line grade book.

Below are a few examples of data, access, and software that might be of use. This list is by no means exhaustive. Would you please provide me with your thoughts on the kinds of data, access, and software applications you would like to have provided to you to assist you in performing you academic functions better.

**************************** ON-LINE DATA NEEDS *************************************

A. From Student Records Files

1. Advisee assigned to me.
2. Student progress toward a degree information (where are they? and what do they need to complete the degree?)
3. Class rosters
4. Majors and minors in my department and information about them.

B. From Alumni Records Files

1. Graduates from my department information

C. From Development Office Files

1. Donors to programs in my department
2. Potential donors to programs/projects in my area.

D. From Financial Records System Files

1. Account balances for accounts I have control over or access to.
2. Recent transactions to the above accounts.

E. From Purchasing Records Files

1. Status of Purchase Requisitions
2. Status of Purchase Orders

F. From Personnel Records Files

1. Student assistant information for students reporting to me.

******************** ON-LINE ACCESS NEEDS ***********************

G. Student Records System

1. Major and minors' files for a department
2. Advisees' records

H. Purchasing System

1. Ability to enter Purchase Requisition on-line.

******************** APPLICATIONS SOFTWARE NEEDS ********************

1. Electronic Grade book

2. Electronic grade reporting (being ability to enter final grades on-line to a grade list.)

3. Down-loading of class list to a workstation.

Please indicate on a 5 point scale (1 = I DON'T NEED IT to 5 = I NEED IT DESPERATELY) your perceived need for each of item on the list and all items you add to the list.

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Appendix 2
The Additional Items Provided by Faculty

Inquiry Only

Student Records System

Access to student transcripts
In/out status while at the university (i.e. which semesters)
Number of courses or load
Local address, mail box, phone, permanent address and phone
Background information such as SAT/ACT scores, high school and graduation rank, citizenship, race/ethnicity
Admission category (i.e. transfer freshman, foreign freshman, foreign transfer, special status, etc.)
Class availability during registration. (Closed/open classes)
Search capability for classes that meet requirements (general) with and without prerequisites
Courses required for various majors

Purchasing System

Inquiry to the entire Purchase Order information not just the number and status.

Personnel Records System

Status of my sick/vacation days
Status of my retirement plan (e.g. years and amount of credits)
List of and information about student worker applications to be able to fit the student to the job

Alumni Record System

Addresses and job status of graduates

Other Administrative Systems

Grants available in my field of research.
International conferences and agenda
Paper abstracts
Minutes of key meetings on campus
Campus telephone book
Campus policy manuals(administrative handbook, faculty handbook, etc.)
Complete catalog of what teaching aids are available and if checked out
Campus Stores catalog (Supplies)
College catalog
College master schedule
University Calendar
Room assignments/reservations
Library Catalog (card catalog information)
Library Loans
Computer software directory
Computer software/utilities manuals

Update and Inquiry

Ability to register students into classes from a faculty office.
Ability to enter a Purchase Order
Work Orders

Appendix 3
Table of Responses to the Questionnaire

Responses --->	1		2				3				4			5			
Questions	n_1	$\%_1$	n_2	$\%_2$	Σ%	Σ(3,4,5)%	n_3	$\%_3$	Σ%	Σ(4,5)%	n_4	$\%_4$	Σ%	n_5	$\%_5$	Σn	Mean
Advisees	68	14%	17	4%	18%	82%	69	14%	32%	68%	71	15%	47%	258	53%	483	4
Degree Audit	52	10%	52	10%	21%	79%	103	21%	41%	59%	69	14%	55%	224	45%	499	4
Class lists	34	7%	31	6%	13%	87%	69	13%	26%	74%	52	10%	36%	355	64%	521	4
Major/minor	120	26%	86	19%	44%	56%	103	22%	67%	33%	34	7%	74%	128	26%	464	3
Graduates info	138	29%	101	21%	50%	50%	103	22%	71%	29%	103	22%	93%	34	7%	479	3
Donor info	206	43%	86	18%	60%	40%	88	18%	79%	21%	103	21%	100%	0	0%	484	2
Potential Donor	138	31%	86	19%	50%	50%	88	20%	69%	31%	69	15%	85%	69	15%	449	3
Account balance	69	17%	0	0%	17%	83%	52	12%	29%	71%	72	17%	46%	224	54%	416	4
Account Trans	69	15%	17	4%	19%	81%	34	8%	27%	73%	103	23%	50%	224	50%	447	4
Open Purch Req	69	16%	34	8%	24%	76%	86	20%	44%	56%	86	20%	64%	155	36%	430	4
Purch Ord Stat	69	16%	34	8%	24%	76%	34	8%	32%	68%	138	32%	64%	155	36%	430	4
Student Assist	103	20%	138	27%	47%	53%	120	23%	70%	30%	34	7%	77%	120	23%	516	3
Update major	172	30%	138	24%	55%	45%	103	18%	73%	27%	69	12%	85%	86	15%	568	3
Update advisee	103	23%	17	4%	27%	73%	69	15%	42%	58%	86	19%	62%	172	38%	447	3
Enter a Pur Req	103	25%	34	8%	33%	67%	86	21%	54%	46%	155	38%	92%	34	8%	413	3
Elec Gradebook	103	23%	52	12%	35%	64%	69	16%	50%	50%	103	23%	74%	116	26%	443	3
Upload grades	69	15%	34	8%	23%	77%	69	15%	38%	62%	155	35%	73%	120	27%	447	4
Classlistsdown	17	4%	52	11%	15%	85%	52	11%	26%	74%	155	33%	59%	198	41%	464	4

Legend: n_i = number of responses to Likert Scale response i.

$\%_i$ = percentage n_i is of the total responses to a given question.

Σ% = Cumulative percentage from response 1 forward to this point.

Σ(3,4,5)% = Cumulative percentage of responses to 3,4,5.

Σn = Total responses to this question.

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Improving Access to Corporate Data: Users Remain Partners in Experimentation

Peggy Bennett
University of Michigan

IMPROVING ACCESS TO CORPORATE DATA: USERS REMAIN PARTNERS IN EXPERIMENTATION

Peggy Bennett
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INTRODUCTION

During the first half of 1991, administrative data users and technical staff of the Information Technology Division (ITD) at the University of Michigan (U-M) continued to make progress in improving end-user access to corporate data. Begun in 1988 with the Data Access Initiative Project, this effort developed in 1990 into the Data Access Pilot Project, Phase 1, which pioneered a relational environment, based on a client/server model, for delivering corporate General Fund financial data to users for ad hoc inquiry and reporting. In this pilot project, Oracle was used as the relational database management system for the corporate data tables with user access from DOS-based workstations on a Banyan VINES network. Phase 1 activities and project recommendations were reported at CUMREC '91 in the session entitled "Improving Access to Corporate Data: Moving Toward a Relational Solution." From January to June of 1991, teams of users and technical staff continued their partnership in several concurrent activities that grew out of the experiences and recommendations of Phase 1 and that collectively represent Phase 2 of this ongoing phased effort, the Data Access Project.

PHASE 2 START-UP ACTIVITIES

University Information Systems (UIS) is the branch of ITD, the umbrella organization which oversees and supports computing at U-M, responsible for administrative computing. Two key recommendations of the Phase 1 team were implemented by UIS immediately following the end of Phase 1. First of all, UIS officially adopted relational tables and Structured Query Language (SQL) as University standards for a corporate ad hoc reporting repository and data access language. Sam Plice, Director of UIS, announced that one requirement of a new computing architecture was that "ad hoc user access will be through SQL to corporate data in relational format."

UIS acted on yet another important recommendation of the Phase 1 user/ITD team by establishing a Data Administration function in November, 1990. Since then, this area has been focusing on data management policies and procedures and on easier access to the University central data resources. The Data Administrator's role has been primarily one of liaison between data stewards, data users, and technical personnel.

PHASE 2 USER/ITD TEAMS AND ITD SUPPORT ACTIVITIES

Users from eight schools and colleges and five central administrative offices participated in Phase 2 activities by serving on the following three teams: the Financial Tables Observation Group, the Macintosh Tool Evaluation Team, and the Data

Availability Plan Committee. Several other concurrent subprojects did not involve users directly, but were addressed "behind the scenes" by staff from UIS and Consulting and Support Services (CSS), the user support branch of ITD. These activities included developing a technical architecture to support end-user inquiry and reporting (UIS Architecture Committee); establishing technical guidelines for creating and maintaining reporting databases from operational systems (UIS Reporting Database Update Team); and developing support, such as training, documentation, and consulting, for the new environment (ITD Support Staff, UIS Oracle Service).

The following sections of this paper highlight the activities of each of these user teams and technical support groups and discuss plans for future phases. Figure 1 depicts the timeframe associated with each subproject, some of which are to continue in the next phase.

Financial Tables Observation Group

Making the General Fund tables available "as soon as possible" was one of the recommendations of the Phase 1 final report. However, many tasks needed to be accomplished to migrate from a pilot to a production environment. Therefore, part of this recommendation stipulated that UIS resources be assigned to review the financial table design; to resolve technical, procedural, and security issues; and to refresh these tables monthly in conjunction with the operational system.

All Phase 1 experimentation was conducted in a central location on DOS workstations connected to a Banyan VINES network. In Phase 2, a small control group of users known as the Financial Tables Observation Group was identified to pilot local connections to the database server from their own offices. The fact that the observation group included Macintosh as well as DOS users introduced another variable into the data access equation. DOS users continued to access the tables through the Banyan VINES network; Macintosh users either used direct Ethernet connections to the campus fiber backbone or pioneered connections through a Secondary Conversion Processor (SCP) to gain access to Ethernet services. This latter prototype was made possible by test software developed internally at U-M. Figure 2 represents the hardware and software configuration used in Phase 2.

In return for the capability of using the monthly snapshot of General Fund data in their actual work, these users agreed to provide information to the ITD team as the basis for extending access to the financial tables to other staff at the University. Specifically, observation of this group was expected to provide ITD with the following information:

- user feedback that would lead to a possible redesign of the tables and/or creation of user "views" to enhance usability.

- user input about future support (training, documentation, consulting) for the financial tables through ITD Consulting and Support Services (CSS).

The Phase 1 financial tables were developed using methodologies formalized in the data processing industry over the past two decades. Design guidelines may in some cases intentionally be broken, however, in order to improve data usability and processing performance, especially in an ad hoc inquiry and reporting environment. Observing how this control group of eight users actually used the Phase 1 tables in their daily work provided valuable input to ITD staff on whether and how the original tables could be tuned or modified to improve access and performance.

The ITD support team visited each user site once a week from March through June to discuss problems, provide assistance, observe progress, and collect information to assist in the final decision about redesigning the model. The support team compared user queries to determine commonality in access paths used, tables joined, fields retrieved, and calculations made. These observations became the basis for a test plan, designed and implemented by the support team, which resulted in several performance enhancements to the original tables. The new tables were in turn tested by users in the observation group for functionality, usability, and effect on response time. To date, the tables retain their original appearance to the users, but modified indexes on virtually all of the original tables have decreased response time considerably by minimizing full table scans. In addition, two user "views" have been developed; these simplify query construction by automatically joining tables commonly related by observation group users.

An annoying and unfortunate technical problem, discovered toward the end of Phase 1, but encountered much more often during the Phase 2 observation period, was that of "run-away" queries. In the Oracle client/server environment, queries cannot be interrupted or stopped by the client (i.e., the user's local DOS-based or Macintosh machine) once the client issues the query and the server, which houses the relational database management system and the data, intercepts control. Run-away queries (those improperly specified by the user, often lacking a complete and accurate JOIN condition) consume processing resources and slow down response time for all users attempting to query the corporate data at any given time. They are, unfortunately, all too easy to issue, and once issued, cannot be stopped except through intervention on the server side. Given the inability to match queries to users on the Banyan VINES server used in Phases 1 and 2, nothing short of rebooting the server could abort a run-away query. This was obviously not a viable environment. Since the end of Phase 2, work has been underway to provide a stable production platform for storing and accessing tables of corporate data. UIS has purchased an IBM RS6000 to house the corporate reporting data. This AIX machine offers the capability of identifying user queries more easily than did the previously-used Banyan VINES server. Operator intervention will still be necessary to cancel run-away queries in the new AIX environment, but at least queries can be matched to users and single processes aborted without rebooting the server.

Throughout the observation process, a representative from CSS collected input from the observation group to inform future campus-wide support for the financial tables. Users translated the experiences they accrued throughout Phase 1 and this observation period into useful ideas about the skills and expertise needed to effectively use the data. They made suggestions regarding job aids and other documentation, training topics, and consulting services, which they considered potentially useful to users with no previous experience with relational technology or knowledge of the financial tables.

The data in the tables used by the observation group represents General Fund information only, i.e., monies from student tuition and state appropriations. This information is slated to be expanded in Phase 3 to enable reporting on revenues and expenditures in other fund areas as well as General Funds, e.g., research funds, auxiliary funds, and endowments. The proposed tables will then support what is known as "All Funds" processing. As a first step in expanding this information, a subgroup consisting of financial data users and ITD staff, will evaluate the General Fund table model as a starting point for a model to provide All Funds data. (See the section entitled *Data Availability Plan Committee*). New data elements may be needed in the current tables or additional tables may needed to support these new fund areas. The work of the financial data subgroup will eventually result in a finalized design and a plan for support of the resulting financial table model(s). These tables will be made available to a broader base of users as soon as a more stable platform for storing and accessing the tables is developed, connectivity to user offices is established, and support is available from CSS.

Macintosh Tool Evaluation Team

The second of the three activities in which users participated was evaluation of Macintosh query tools. Since all Phase 1 experimentation had been performed with tools on DOS machines, Phase 2 concentrated on Macintosh tools for the substantial number of administrative data users who work in a Macintosh environment. The charge of the Macintosh Tool Evaluation Team was to perform hands-on evaluation of several Macintosh query tools for accessing corporate data stored in an Oracle database. This group consisted of nine users and two ITD staff members who met for weekly evaluation sessions in a central Macintosh lab on campus.

For this evaluation, the Technology Assessment Group of UIS did some advance research to identify query tools that provided four capabilities for the current Data Access environment:

- running in client/server mode, that is, on a client machine with access to tables on a database server
- running on Macintosh client machines
- accessing Oracle databases
- working on the SQL*Net TCP/IP platform

Evaluation copies of the following tools were subsequently secured from the respective vendors:

- DataPrism from Brio Technology, Inc.
- ClearAccess from Fairfield Software
- Query Tool from Oracle Corporation
- GQL from Andyne Computing Limited

The team developed and implemented a plan of action, which began with a brief demonstration of each tool, followed by in-depth, hands-on experimentation with the financial tables on the UIS Oracle server. Most query tools for the Macintosh, the group discovered, provided a more usable interface than the DOS tools evaluated in Phase 1. However, although these Macintosh tools hid many of the complexities involved in query-building from the user, none of them managed to completely eliminate the need for a basic knowledge of Structured Query Language (SQL).

The group ruled out Oracle's Query Tool and Fairfield's ClearAccess, based on a variety of functionality and usability factors; DataPrism and GQL remained as the two top contenders. Most of the team members then engaged in on-site experimentation with these two tools from their own offices for several weeks, after which the team reconvened to discuss its findings and conclusions. Although both GQL and DataPrism generated positive feedback, almost all of the members of the team felt that GQL was a superior product to DataPrism in two primary areas: building complex search criteria, and storing queries for easy retrieval by novice users. The consensus was that DataPrism is easier to use for the novice, but it is far less powerful than GQL.

The team's final recommendation was that both GQL from Andyne Computing and DataPrism from Brio Technology be supported by ITD for Macintosh access to corporate data in an Oracle database. If limited resources render the support of a second product impossible, the evaluation team recommended that GQL be selected for support over DataPrism.

A report outlining the evaluation process and providing supporting material for the evaluation team's recommendation was submitted to the ITD Selection Committee, a group charged with determining which products will be selected for support campus-wide. This document predicts that the use of query tools will grow on campus as more and more corporate data becomes available in relational format. Because of the great potential for their use, the report suggests that a reasonable pricing scheme be negotiated for both of these products. Supporting these tools should be a relatively simple and low cost operation. Because they are designed to be friendly to use, these tools will likely generate very few questions compared to other applications. A one-time workshop in GQL may be very useful for many members of the University community, but most users will probably not require a workshop in DataPrism. Endorsement of the team's recommendation by the ITD Selection Committee will result in ITD offering support services and reduced prices for DataPrism and GQL to users at the University.

Data Availability Plan Committee

Another recommendation of the Phase 1 team was that users be involved in developing a plan for providing additional corporate data in relational format to support ad hoc inquiry and reporting and in assigning priorities for sequencing the conversion of this data. To respond to this recommendation, the Data Availability Plan Committee, the third of the three Phase 2 groups in which users participated, was convened.

This group of 14 users and 4 ITD representatives, led by the UIS Data Administrator, met biweekly to address the following components of the committee's charge:

- determining which datasets would be converted to relational format and when.
- identifying issues involved in converting each dataset to relational format -- e.g., the need for reconciliation of data conflicts and campus-wide data definitions; costs associated with creating/storing/maintaining data; issues concerning data ownership, redundancy, integrity, timeliness, sharing, independence, security, and privacy; and issues involving support (including documentation, consulting, and training).
- identifying participants for implementation groups to study and resolve the issues associated with each dataset or to determine which of the issues need to be referred to other groups for resolution.

- determining the impact of identified issues on the proposed timetable for conversion, and adjusting the timetable as necessary.

- recommending the resultant plan for data conversion to UIS management.

Users on this committee began by identifying data that would support management decision-making in their units, such as alumni/donor, financial, personnel, research, and student data. Some data identified as being potentially useful is not currently captured in electronic format. To expedite development of some early deliverables, the committee decided that data to be provided in relational format initially must be data that already exists in electronic format at the University.

The committee then turned to the arduous task of determining the sequencing of datasets to be considered for migration to relational format. Users discussed their highest priorities for converting data and decided to direct their energies toward a core set of personnel data, a core set of student data, and an enhanced set of financial data.

Phase 1 users had already suggested that adding support of All Funds processing to the Phase 1 General Fund data would be most useful to them as a next step in delivering financial data in relational format. This would give them the added capability of reporting on revenues and expenditures in their units for fund areas other than General Funds, such as research funds, auxiliary funds, and endowments. (See the section entitled *Financial Tables Observation Group.*) The Data Availability Plan Committee corroborated this recommendation.

To determine what would constitute the core student and core personnel datasets, the committee was presented with information on the student and personnel systems by representatives from the Registrar's Office and the Personnel Office. The group then discussed applications for student data and reached consensus on "Official Third Week Count" data as the core student dataset to be converted initially. This data represents student enrollment figures reported to the state as of the end of the third week of a term, the official drop/add deadline. The same process was used with personnel data, and although the exact application in the personnel area remained to be identified at the end of Phase 2, discussions had narrowed down the possibilities to three types of files: a census file, a fiscal year compilation, and a dynamic view of changing personnel characteristics and appointments. Advantages and disadvantages of each of these approaches were discussed by the committee.

In the future, committee members hope to be able to relate different categories of data to each other. For example, users would like to be able to report on student employees, which means accessing both the student and personnel datasets by means of a single query. This capability will, of course, require that data conflicts across the financial, student, and personnel systems be reconciled; that common definitions of data across systems be developed; and that the timing of updating the various datasets be synchronized.

At the end of Phase 2, the Data Availability Plan Committee was in the process of identifying participants and finalizing charges for three implementation groups. The financial, student, and personnel data subgroups are to study and resolve the issues associated with converting each dataset and model the data required to support the applications identified by the committee. All of these subgroups will report progress to the Data Availability Plan Committee, which will continue to meet, but on a less frequent basis. The committee will act as an advisory board for the subgroups and continue its formulation of a long-term plan for conversion of additional corporate data to relational format for ad hoc inquiry and reporting.

UIS Architecture Committee

The UIS Architecture Committee, an internal UIS group, was convened to determine requirements for an architecture to support ad hoc inquiry and reporting of relational corporate data. This new architecture must not only address new capabilities involved in accessing administrative data for reporting purposes, but also ensure that such an environment can successfully coexist with existing operational systems (such as those used in the central Personnel Office, Payroll, Registrar's Office, and Financial Operations), as well as new ones.

Phase 1 of Data Access pioneered a client/server environment for delivering data to users for inquiry and reporting. UIS intends to move users gradually away from central mainframe processing and toward a client/server architecture for ad hoc data retrieval and reporting. Oracle's Relational Database Management System (RDBMS) provides the flexibility of running on a variety of platforms and operating systems; it seems well suited, therefore, to the U-M environment, in which departments with diverse configurations of technology want to share data and applications. However, a major problem in the industry today is adequate provision of security in the client/server environment. The financial tables developed in Phase 1 were not subject to any security restrictions; however, personnel, student and other corporate data may well be. Although the next release of Oracle (version 7) promises improved security features, Oracle currently does not provide adequate user authentication and access control based on data values.

Another RDBMS, used for several operational systems at UIS, is DB2. Although this database runs only on IBM mainframes, tables in DB2 databases can be accessed in a client/server environment by means of gateways. Gateways are products which interconnect two otherwise incompatible networks or devices; they can be hardware devices (routers, bridges, servers) or software applications (mail, databases, network protocols). Because DB2 runs on IBM mainframes, it has the capability of interfacing with the administrative mainframe's security software, Top Secret, and thus provides both user authentication and access control based on data values for ad hoc reporting.

Because of the as yet unresolved security issues, decisions on the use of Oracle or DB2 for datasets designed for ad hoc inquiry and reporting will continue to be made on a case-by-case basis, depending on the specific characteristics and requirements of the data to be made available (e.g., financial, personnel, student).

If some corporate reporting data ends up in DB2 for security reasons, users would still like to be able to use the query tools they recommended for support in Phases 1 and 2 to access it. Work is currently underway, therefore, to test Oracle's SQL*Connect gateway to DB2 with the DOS-based query tools SQL*Plus, SQL*QMX, and the Oracle Add-in for Lotus 1-2-3 and the Macintosh query tools GQL and DataPrism. More research and testing remains to be done. One test will consist of experimenting with the possibility of relating, for example, financial data in an Oracle database and student data in a DB2 database. In the interim, the forward momentum of the Data Access Project has continued. In late summer 1991, a group within UIS began experimenting with a new AIX-based server which is more powerful in terms of memory and disk space than the ones used in Phases 1 and 2. (See the section entitled *Financial Tables Observation Group.*) It is anticipated that this machine will provide an adequate platform for the extension of the financial tables developed in Phase 1 to additional users, as well as providing a platform for other Oracle datasets to be developed in the near future. Testing results will provide information for future UIS Architecture Committee discussions.

UIS Reporting Database Update Team

As stated in the section *Financial Tables Observation Group*, many tasks needed to be accomplished in order to migrate from a pilot to a production environment. In specific, it was imperative that UIS staff resolve the technical and procedural concerns involved in updating reporting databases in conjunction with the operational systems from which they are derived. This process is known as "refreshing" the reporting data.

To address these types of issues, another internal UIS committee was charged with establishing guidelines for maintaining images of information derived from operational systems for ad hoc inquiry and reporting. This group of eight ITD staff has been conducting research and discussing results to develop guidelines for all UIS staff members involved in maintaining tables for inquiry and reporting purposes.

The team reviewed approaches for creating, loading, and maintaining relational tables from operational systems used by UIS in past pilot projects. This orientation was intended to reveal the range of refreshment options used and to document some of their advantages and disadvantages.

Team members developed a list of important factors to consider in creating standards for refreshing reporting tables (e.g., database management systems [DBMS] used, platforms involved, update timing required). Because of platform and DBMS issues, guidelines must be developed in concert with findings from the research and testing conducted by the UIS Architecture Committee.

Characteristics of the "ideal" refreshment process, such as minimal manual intervention and efficient use of system resources, were identified and documented. From this characteristics list, the group plans to determine what is required to achieve each characteristic and to identify the contingencies and criticality of these characteristics. Results of this research will provide the basis for guidelines and standards for future projects.

ITD Support Staff

The Phase 1 final report recommended developing education in relational concepts for users and ITD staff. As a result, UIS developed a half-day seminar in basic concepts of relational technology. This seminar, which is offered periodically to ITD staff, includes an overview of relational technology, client/server architecture, distributed data, and networking considerations.

Another Phase 1 recommendation was that tool training, documentation, and consulting be provided for the three DOS-based query tools highly rated by users in

Phase 1: SQL*Plus, SQL*QMX, and the Oracle Add-in for Lotus 1-2-3. Since all of these tools are based on Structured Query Language (SQL), UIS also developed a hands-on training session in SQL fundamentals as a first step in the process of providing training on specific tools.

At the end of Phase 2, staff in the user support area of ITD, Consulting and Support Services (CSS), began taking advantage of these internal training opportunities to prepare for supporting users in concepts of relational technology, basics of SQL, and usage of SQL*Plus, SQL*QMX, and the Oracle Add-in for Lotus 1-2-3.

CSS is also soliciting user input from the Financial Tables Observation Group to determine what support will be required for those using the financial tables. (See the section entitled *Financial Tables Observation Group.*) These ideas will also be used to develop similar educational possibilities for users and ITD staff in other areas of corporate data, as new ones become available in relational format. In addition, CSS representatives will serve as members in the financial, student, and personnel data subgroups of the Data Availability Plan Committee in order to be directly involved in the process of defining and developing the new tables. (See the section entitled *Data Availability Plan Committee.*) This participation should provide valuable first-hand knowledge of the data elements, definitions, and relationships contained in the three resulting data models, which can then be translated into support mechanisms for educating users.

UIS Oracle Service

In May 1989, U-M purchased a site license for Oracle products. This agreement with Oracle Corporation was arranged as a result of a campus-wide committee determining that Oracle best addressed the University's needs for an RDBMS which would run in a distributed and networked environment, consisting of numerous platforms ranging from individual departmental workstations to mainframes. Several U-M units, known as "buy-in units," have been participating in this agreement, and a number of these schools/colleges are developing departmental systems with Oracle. Since Oracle had already been introduced on campus, the Data Access Pilot Project Team tested Oracle in Phase 1 for its usefulness as a repository of corporate data in an ad hoc reporting environment, and for its functionality and usability in accessing this data.

The Phase 1 final report specified that UIS continue to work closely with Oracle Corporation representatives to strive for increasingly improved Oracle service for the University. This has indeed occurred. Furthermore, in the spring of 1991, the ITD Evaluation Team for Oracle Support, a group charged with determining how best to support Oracle at U-M, submitted a report outlining a series of recommendations for campus-wide support of Oracle to ITD senior management. An implementation group, led by UIS and consisting of representatives from units which did not buy into the site license, as well as representatives of the buy-in units, has been formed to set priorities for provision of service based on these recommendations.

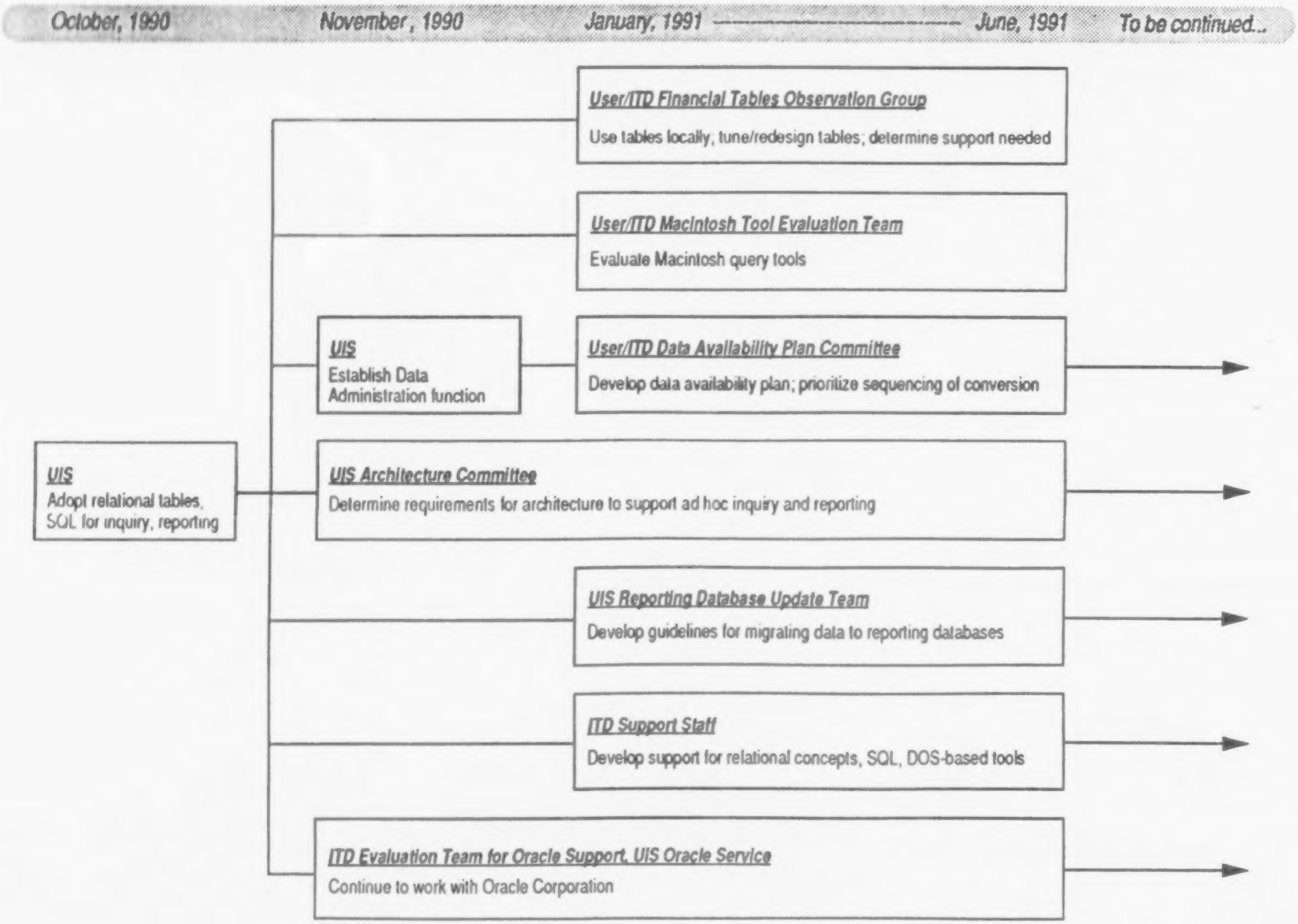
SUMMARY

Figure 3 represents an overview of the highlights of the Data Access Project to date and places Phase 2 activities into the context of the overall project. The plans outlined for Phase 3 are, like those of Phase 2, an outgrowth of the experiences and recommendations of the previously completed phases.

Throughout this evolving process, ITD has been continually encouraged by the enthusiasm of users from the University community and by their ongoing participation in Data Access activities. Several demonstrations and presentations of progress in the Data Access arena were conducted during the course of Phase 2, two of which were organized and conducted by Data Access Project participants from user offices. One of these overviews was presented to a group of University employees who use financial data in their work; the audience was particularly impressed with how easy corporate financial data was to access and use in the new relational environment. The second demonstration was conducted at a U-M rollout of Macintosh System 7, at which the Macintosh query tool GQL was demonstrated for its ease of use in accessing relational corporate data. On June 28, 1991, a presentation on Data Access activities to date, "Where We've Been, Where We Are, Where We're Going...," marked the official close of Phase 2. At a meeting of an established user group for administrative computing, users who were active in Phases 1 and 2 of the project assisted UIS staff in discussing activities and results and in demonstrating query-building with workstation-based tools. These Data Access user team participants have generated considerable enthusiasm among other users on campus.

As outlined in several sections of this paper, there are still some unresolved issues regarding the new corporate data inquiry and reporting environment, most notably the necessity of aborting run-away queries through operator intervention and the lack of adequate security in the client/server environment. In Phase 2, balancing heightened user expectations resulting from the growing enthusiasm on campus with the reality imposed by the still unresolved issues continued to remain a challenge. However, users who participated in Phases 1 and 2 were well aware of these limitations and have been willing to work with ITD staff to address them. The spirit of experimentation they continue to demonstrate underscores the true partnership in which they and ITD staff have been engaged to improve corporate data access at the University of Michigan.

Data Access Project, Phase 2



October, 1990 November, 1990 January, 1991 —— June, 1991 To be continued...

UIS
Adopt relational tables, SQL for inquiry, reporting

User/ITD Financial Tables Observation Group
Use tables locally; tune/redesign tables; determine support needed

User/ITD Macintosh Tool Evaluation Team
Evaluate Macintosh query tools

UIS
Establish Data Administration function

User/ITD Data Availability Plan Committee
Develop data availability plan; prioritize sequencing of conversion

UIS Architecture Committee
Determine requirements for architecture to support ad hoc inquiry and reporting

UIS Reporting Database Update Team
Develop guidelines for migrating data to reporting databases

ITD Support Staff
Develop support for relational concepts, SQL, DOS-based tools

ITD Evaluation Team for Oracle Support, UIS Oracle Service
Continue to work with Oracle Corporation

Figure 1

Network Configuration

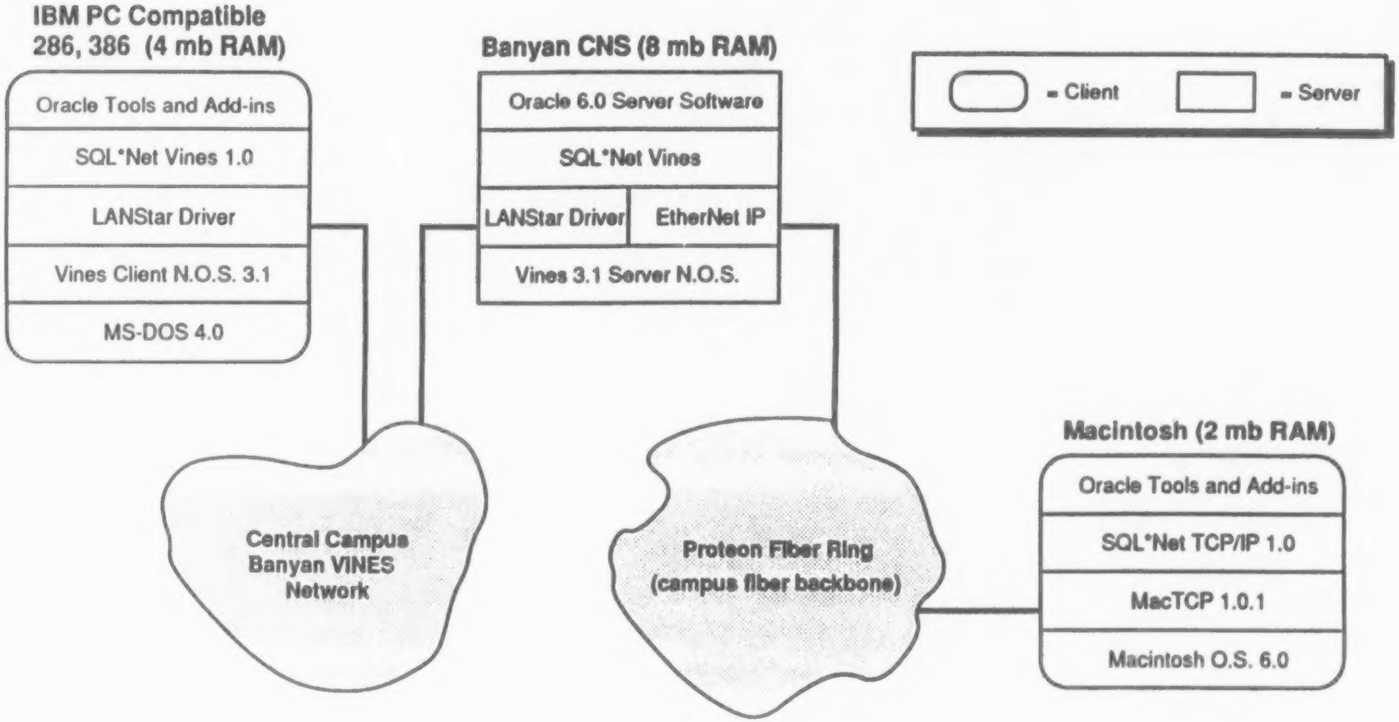

IBM PC Compatible
286, 386 (4 mb RAM)
Oracle Tools and Add-ins
SQL*Net Vines 1.0
LANStar Driver
Vines Client N.O.S. 3.1
MS-DOS 4.0
Banyan CNS (8 mb RAM)
Oracle 6.0 Server Software
SQL*Net Vines
LANStar Driver
EtherNet IP
Vines 3.1 Server N.O.S.
= Client
= Server
Central Campus
Banyan VINES
Network
Proteon Fiber Ring
(campus fiber backbone)
Macintosh (2 mb RAM)
Oracle Tools and Add-ins
SQL*Net TCP/IP 1.0
MacTCP 1.0.1
Macintosh O.S. 6.0

Figure 2

Highlights of the History of Data Access 1988-91 and Plans for 1991-92

1988 (January–September)

Data Access Initiative Project

Users/ITD Identified Highest Priority for Improving Administrative Data Access:

- Prepare for a new data retrieval environment based on relational technology

1990 (January–September)

Data Access Pilot Project, Phase 1

Users/ITD Instituted Pilot Project to Test Relational Approach to Administrative Data Access:

- Developed pilot financial tables
- Evaluated DOS-based query tools
- Experimented with client/server technology to enable merging of corporate and departmental data
- Compiled experiences into recommendations for future work

1991 (January–June)

Data Access Project, Phase 2

Users/ITD Addressed Several Phase I Recommendations:

- Adopted relational tables, SQL for administrative ad hoc inquiry/reporting
- Established Data Administration function
- Refined financial tables based on experimentation in user offices
- Evaluated Macintosh query tools
- Began to develop Data Availability Plan; developed charges for Student, Personnel, and Financial Data Subgroups
- Began to determine requirements for architecture to support ad hoc inquiry/reporting
- Began to establish technical guidelines for creating reporting databases from operational systems
- Began to develop support for new environment

1991-92 (July–March)

Data Access Project, Phase 3

Users/ITD to Continue Addressing Phase I Recommendations:

- Further develop Data Availability Plan
- Expand financial tables to enable All Funds processing
- Examine Official Third Week Count tables for student data reporting
- Develop core set of tables for personnel data reporting
- Continue to develop architecture to support ad hoc inquiry/reporting
- Determine charging mechanisms for providing relational administrative data to users
- Continue to establish technical guidelines for reporting databases
- Extend financial table access to additional users
- Test DOS and Macintosh query tools against DB2 data
- Develop support for financial data, relational concepts, SQL, DOS and Macintosh query tools
- Evaluate DOS query tools for Windows environment

Figure 3

37th Annual College and University
Computer Users Conference

"Discover New Worlds With Technology"

Alternate

The Changing Nature of the Support Functions of the Florida Information Resource Network (FIRN)

Carl Hansen
Central Florida Community College

THE CHANGING NATURE OF THE SUPPORT FUNCTIONS OF THE FLORIDA INFORMATION RESOURCE NETWORK (FIRN)

A Structured Shift From Hardware And The Data Centers To Software and the End Users

by Carl T. Hansen, FIRNTEC
Central Florida Community College

Introduction.

The Florida Information Resource Network (FIRN) is a computer network that interconnects all the public education entities in the state, and several supporting agencies as well. In this presentation I shall outline the network in general to provide the background necessary to understand the user support structures and their evolution. The primary thrust is to outline the development and implementation of the FIRN user support system.

Entities Served.

The principal clients on the network are the five regional data centers, nine state universities, twenty-eight community colleges, and sixty-seven school districts. Other participants are education entities such as the Florida School Book Depository and the contractor for the post secondary student financial aid system. Some other schools are included as separate entities from school districts - such as the laboratory schools and the Florida School for the Deaf and Blind. Other state government agencies are being connected as needs arise.

These entities vary greatly in size, funding, and sophistication. In terms of student population, the universities are large enough to have considerable computational resources and the staffs to support them. The community colleges and school districts differ widely in these respects. The community colleges have student populations ranging from over fifty thousand to under one thousand. The school district student populations range from over a quarter of a million to under a thousand.

Systems Connected.

Hardware.

The hardware the network interconnects is an exercise in computational diversity. The regional data centers, which are part of the state university system, have large mainframe computers - four are IBM 3090 series, and the fifth is a Digital VAX 8800. The universities themselves have a wide variety of machines ranging from PC networks to Unisys, DEC and IBM Minicomputers to IBM mainframes and CDC Cyber supercomputers. The community colleges have a similar spread of equipment, as do the school districts (with the exception of the upper end research-grade machines). Internal communications architectures range from sneaker net (create an upgrade diskette and run around to the schools and load it on their PCs) to large mainframe networks with hundreds of terminals and LANs attached.

Systems Software.

The total diversity of systems software exceeds that of hardware considerably! Fortunately, there are only two major communications architectures to contend with at the moment - IBM's Systems Network Architecture (SNA) and the ISO X.25 Communications Standard. Crossing from one of these two architectures to the other is not quite user-transparent, but it is workable. Other protocols are also being tested and used.

External Links.

In addition to the network interconnections, links to various external networks such as Bitnet, the Internet, Usenet, etc. are provided for network users. These linkages are continually being improved and documentation on them disseminated.

Batch/Interactive Processing.

The initial emphasis and primary purpose of the network was to provide for a standardized reporting means for the educational community so that essential administrative, legislative and federal reporting functions could be accomplished accurately and efficiently. This dictated that databases and batch file transfers be given a priority. The requirement to provide service available to all Florida educators dictated that interactive capabilities also be designed into the network.

History.

The January 1982 document, Florida Information Resource Network, A Plan to Build Upon, was developed as a cooperative effort between the Florida Department of Education (DOE) and the School District Council on Comprehensive Management Information Systems (SDCCMIS) outlines the background of FIRN as follows:

> A Florida Educational Computing Network has been a goal of the Florida Legislature since 1973. Proviso language was incorporated in the respective appropriations acts, and funds were provided during 1978 through 1981 to enable educational institutions to acquire and share computer hardware and common applications software.....

As quoted in the plan, the SDCCMIS and the DOE were charged by the Florida Legislature to:

> ...develop a plan for the implementation of a FIRN..... The plan ... shall provide for an organized process of identifying information needs, collecting and processing data, and providing information for decision making. The plan shall lead to an automated delivery system of information, flowing from the individual schools through the district to the state and back....The goals of the network are the reduction of the data burden on teachers and other personnel....

Proposal/Plan.

The 1982 plan listed many benefits of having a FIRN. In addition to the benefits of automating many administrative processes and reporting requirements, the plan spoke of reducing the data burden on teachers and "establishing the foundation for the integration of administrative and instructional computing to support the activities such as Computer Managed Instruction." Electronic Mail was also listed as one of the benefits to be gained.

Time Phasing.

The plan called for five distinct phases, with specific activities and goals within each phase. It also stated that "...circuit riders (individuals), capable of assisting the users of the twenty district and/or regional centers, will be needed during each phase of implementation." It also foresaw the need for increased support in the final phase.

The five phases were defined as:

> PHASE I - SEMI-AUTOMATED CAPABILITY AT THE DISTRICT AND/ OR REGIONAL LEVEL USING MAGNETIC TAPE TRANSFER OR DATA COMMUNICATIONS TRANSMISSION TO THE DOE.
>
> PHASE II - AUTOMATED CAPABILITY AT THE DISTRICT AND/OR REGIONAL LEVEL USING MAGNETIC TAPE OR DISKETTE TRANSFER WITH INCREASED DATA COMMUNICATIONS TRANSMISSION TO THE DOE.
>
> PHASE III - AUTOMATED CAPABILITY AT THE DISTRICT AND/OR REGIONAL LEVEL WITH BATCH BI-DIRECTIONAL DATA COMMUNICATION TRANSMISSION OF STRUCTURED INFORMATION SUCH AS FTE, ... AND COST REPORTING. (Note: FTE is Full-Time-Equivalencies)
>
> PHASE IV - INTERACTIVE AD HOC INFORMATION (STUDENT, PROGRAM, STAFF, FINANCE, FACILITY AND COMMUNITY) RETRIEVAL AND REPORTING CAPABILITY FOR DISTRICT, DOE AND LEGISLATIVE LEVELS OF EDUCATIONAL MANAGEMENT.

> PHASE V - INTERACTIVE AD HOC INFORMATION (STUDENT, PROGRAM, STAFF, FINANCE, FACILITY AND COMMUNITY) RETRIEVAL AND REPORTING CAPABILITY FOR SCHOOL, DISTRICT, DOE AND LEGISLATIVE LEVELS OF EDUCATIONAL MANAGEMENT.

The report went on to say that:

> During Phase V, the resources of the FIRN will be made available at State, school district and school levels. Therefore, a substantial financial investment will be required during Phase V to provide for the devices (micro-computers or terminals), data communication lines, Information Processing Hardware, Information/Application Software and technical staff required to support 2,345 schools state-wide.

The report was published in January of 1982, only four months after the initial introduction of the IBM PC, which makes the inclusion of microcomputers in the above quote an illustration of why this is a truly visionary document.

The January, 1982 plan also provided for the growth and maturation of FIRN.

> However, it should be recognized that a broad governance structure is being presented and that the structure will facilitate the inclusion of other educational delivery systems (State University System, Community Colleges and Vocational Education) at a later point in time, without requiring major modification.

In fact, by the time of publication of the next formal report to the Legislature in January of 1983 it was acknowledged that the inclusion of the Universities and Community Colleges was an integral part of the development of FIRN.

Funding.

Funding for the network has varied greatly during these developmental years. The peak years correspond to the periods of greatest hardware and software installation and development.

FY	FUNDING
82-83	518,577
83-84	2,729,895
84-85	4,396,415
85-86	5,853,230
86-87	5,778,230
87-88	5,769,083
88-89	5,747,137
89-90	5,747,137
90-91	4,936,851
91-92	5,633,042*

*After an 8.39% budget cut, with more cuts expected.

Support Staffing.

Initial support staffing called for personnel at each node to support hardware, personnel for software development support, and "Circuit Riders" to assist data center and reporting personnel in the districts. By the time of the Fourth Annual Report to the Legislature in January of 1985, this support structure assumed a form, which would then change only in degree and nomenclature as areas of emphasis changed in subsequent years until the addition of FIRNSOLs in 1991.

The primary personnel categories were:

Network Technical Staff -- personnel that maintain the network, its [network] software, and any upgrades called for by changes in user needs and technology. (NOTE: These are not primarily user support persons, but form an invaluable link between the users, the support staff, and the network itself.)

Installation Staff -- technical staffing required to assist the districts with the implementation of the communications links between schools, school districts, and the network. In addition, these staff will provide aid in installing software packages provided by others and in interfacing district software with the network.

Circuit Riders -- technical assistance personnel stationed around the state to aid school districts in the use of various software packages provided by a host computer or by the state.

By 1987, the direct user support role began to shift more toward end-users and applications as the connections became more established and the data center personnel more experienced in their roles (From the Seventh Annual Report, April '88):

> FIRN also provides funding for school district personnel who serve as local network support consultants. This funding provides for staff located in selected districts for the purpose of answering communication and application questions pertaining to the network. Because of their role as a consortium, or because of the size of the individual district, 22 school districts have been identified as service unit support sites. Currently there is one support staff for the community colleges; another will be added next fiscal year. In providing local support for end-users, these service unit support staff (SUSS) enable the FIRN staff to more effectively respond to technically oriented questions and problems.

Finally, FIRN was beginning to place more emphasis on instructional computing support. With the completion of community college connections to the network, administrative needs, previously FIRN's primary concern, will be handled in a supportive role while instructional support becomes an area of increased emphasis.

The inclusion of a support person for the community colleges is significant, because that position later formed the model for subsequent implementation of support strategies. This position was to serve all twenty eight Community Colleges, ranging geographically from Key West to Jacksonville to Pensacola! While assisting the data centers and the DP and MIS personnel in establishing connections, reporting and other administrative computing tasks, this person was also responsible for the inclusion of academic computing personnel and data centers into the system as users. That proved to be a non-trivial task! The pertinent duties of that position, which was located at Central Florida Community College (CFCC) in Ocala were listed as:

> Responsible for:
>
> -enhancing the state-wide FIRN connection/linkages to community colleges and the 5 regional data centers.
>
> -providing technical assistance in the selection, use, and maintenance of hardware.
>
> -training users in accessing the applications available through FIRN and in the understanding and use of those applications.
>
> -serving as liaison between the user community and community college data staffs in support of college and state informational databases. On-site visits within the community college system are required to troubleshoot, provide training, and facilitate information exchange among users.
>
> -using several electronic mail systems to communicate with other colleges and state personnel.
>
> -assisting in the automated submission of state reports.
>
> -attending all pertinent workshops and conferences, including the semiannual School District Coordinating Council for Management Information Systems (SDCCMIS) meetings.
>
> -assisting School-District FIRN Service Unit Support Staff (SUSS) where necessary and appropriate.
>
> -in the CFCC support role (20% of the time), providing systems analysis and microcomputer/networking support.

By the following year (1988), the role of the School District SUSS had begun to change. Where they originally had duties primarily in support of the school district in which they were located and the consortia to which they belonged, a more flexible role was evolving through needs generated by the changes in the network requirements as it grew and matured. Most of the fundamental reporting system database work was nearing completion, and the data communications connections were largely made. More and more non-DP users were requiring assistance as the reporting requirements were implemented. Many of these users were administrators and staff responsible for reports or who utilized the interactive applications being added to the network - applications such as the Standardized Course Numbering System and the Teacher Certification database. (From the Eighth Annual Report, February 1989):

> FIRN also provides funding for school district personnel who serve as local FIRN network support consultants. Known as Service Unit Support Staff (SUSS), the role of this auxiliary staff becomes more and more important as FIRN grows and encompasses a widening area of service. These SUSS support the technical and FIRN application needs of school districts and community colleges, while serving as liaisons who disseminate network developments and provide instruction for their user community when necessary.

During 1989 the concept of FIRN auxiliary staff based outside of Tallahassee, but primarily responsible to the network's administration rather than that of the school district or community college where they were based was formalized and implemented. The modus operandi initiated by the first community college FIRN staffer was being spread throughout the system. What had started as one person for all twenty-eight community colleges (later augmented by a second community college support staffer) was increased to an authorized set of ten FIRN staff, now called Technical Education Consultants (FIRNTECs), stationed throughout the state and functioning on an area support basis. The transition period included the use of remaining SUSS staffers in school districts to function as DSS (see below) for a short period of time. (From the Ninth Annual Report, February 1990):

> FIRN also provides funding for auxiliary FIRN staff housed at school district and community college sites. These remote staff help promote the use of FIRN and provide technical assistance and training for the FIRN user community.... As FIRN continued to grow and expand, the demands on SUSS were such that a conflict between FIRN needs and district needs arose. Resolution came about with the redefinition and renaming of the remote staff: District Support Staff (DSS) are funded to assist with DOE Data Base concerns; FIRN Technical Education Consultants (FIRNTEC) are funded to serve as training coordinators and consultants who can assist the user community with the use of FIRN.

During 1990, the FIRNTEC support concept was fully implemented - personnel were hired, trained and based at cooperating institutions. They are fully funded by FIRN, and the supporting agency gets 20 percent of the FIRNTEC's time in return for administrative and logistical support.

(From the Tenth Annual Report, January 1991):

> FIRN also provides funding for auxiliary FIRN staff housed at school district or community college sites. These remote staff help promote the use of FIRN and provide technical assistance and training for the FIRN user community. Known as FIRN Technical Education Consultants (FIRNTEC) these staff serve as training coordinators and consultants who provide assistance in the use of FIRN.

As the network matured and the FIRNTECs were busily supporting the network's users in terms of data communications and computer applications, the need for specialists in supporting instructional applications became obvious. Again, the network, in conformance with the ongoing mission of supporting the needs of Florida's educators, has responded with a new category of support - two experienced teachers hired to work with, develop, and train teachers in instructional applications. Now the network is reaching not only the College/District or even the school, but into the classroom! (From the draft of the Eleventh Annual Report, to be published in January 1992):

> A new group of support staff was added this year to assist with FIRN's involvement in instructional applications. Two FIRNSOL (FIRN Support for Online Learning) staff are now available to provide training and conference presentations about adapting FIRN's use within classroom curriculums in Florida.

Current Efforts.

Several areas of major effort to provide better service to the educators and students in the state involve grades, records and reports. These efforts have major implications for the utilization of the FIRNTEC user support concept. More personnel may be required, but the FIRNTECs have already proven themselves among the most cost effective adjuncts to the network and its user community.

> The ACT and SAT scores are now sent to the state in electronic format by the testing agencies, so that they can be accessed by the students and the schools designated to receive them directly. This saves time, effort, and money.
>
> The College Level Academic Skills Test (CLAST) results are made electronically available to students and schools. Passing this test is required for students to move into the upper division of the Universities or to graduate from the AA degree programs in the Community Colleges and qualify for transfer into University programs.
>
> The Florida Automated System for Transfer of Electronic Records (FASTER) is a statewide system for the automated transfer of student transcripts among all academic institutions - whether the records are those of an elementary school student moving from one part of the state to another or a high school senior sending records while applying to several universities or colleges within the state. Efforts are underway with the Federal DOE and several other states to adapt this system to interstate transfers as well.

Other efforts involve providing more and better support for classroom teachers and students:

> The University and Community College library information systems are being expanded to provide easier and more complete access to information on library holdings and to facilitate their research and study efforts.
>
> Electronic mail has been made available, free of charge, to all educators in the state. Currently this system includes a limited conferencing capability in addition to the mail facility. Further enhancements are on the way.
>
> The Telecommunications Opportunities for Gifted Learners (TOGL) provides enhancement opportunities for gifted students.
>
> Programs can be made available for providing opportunities for selected students to interact with their counterparts on an international basis. The Florida-England connection was the first of what will probably be many such activities.
>
> Databases, such as the Free-For-Teachers environmental education resource database provide current sources of information for up-to-date classroom programs.
>
> The Department of Education Electronic Bulletin Board (DOEEBB) provides a means of information dissemination and a forum for special interests. The new DIG file in the DOEEBB, for example, provides an Archaeological information source.
>
> The WEATHER facility provides the capability to download and display daily weather maps from NOAA satellites in addition to other specialized weather maps and information.

Summary.

As we have seen, the network has progressed through its developmental stages. It is now at the point where it forms not only a reporting and administrative support tool, but it is an asset that supports education in Florida down to the individual teacher and classroom level. Network capacity will be expanded as necessary to best serve the needs of the educators. Network applications are as available as the nearest terminal or PC/Modem/Phone Line connection - even from the user's home.

As the support structure has been modified in the past to meet the needs of the network and its users, it will continue to grow and change - it's an interesting and exciting challenge! Areas of emphasis started with the creation of the network itself - with communications hardware and software installation, and have now moved into serving the needs of all educators in the state in a productive and innovative manner!

Although there was considerable overlap, and much of the work went on simultaneously, a rough chronological order of support task priorities was:

Establishing the physical and electronic connections.

Enabling batch file transfers to and from network nodes and to and from Tallahassee.

Creating the data bases and reporting structure necessary to meet the needs of the educational entities, the state DOE, and the legislature.

Creating the interactive applications needed within the state, and the capability to use them across dissimilar hardware architectures.

Assisting users with custom or limited use applications in their development.

Generalized Administrative/Educator Support.

Support for all Educators.

Classroom/Student Support.

The work goes on. FIRN is a living, growing, maturing entity which is constantly changing. It was created by visionaries and is supported by believing disciples. It is the most advanced network of its kind in the world.

Handouts: Copies of overheads and general FIRN descriptive brochures.

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Alternate

Design, Implementation and Management of a Large Complex Fiber Optic Network

Raymond Neff
Case Western Reserve University

Design, Implementation and Management of a Large Complex Fiber Optic Network

Dr. Raymond K. Neff
Vice President for Information Services
Case Western Reserve University

ABSTRACT

Case Western Reserve University is operating the first all fiber optic communications network on a university campus. When completely installed, this system of some eight thousand outlets will interconnect all faculty offices, student rooms, classrooms, libraries, and laboratories with computer data, telephone, audio, video, fax, and image information resources. We refer to the system as CWRUnet and pronounce it "crewnet."

CWRUnet features a standardized premise, wire-once cabling architecture, independence of cabling and optoelectronics, and support for multimedia communications. Phase I of the network became operational in August 1989 for students in the University's sixteen residence halls. Phases II and III connecting faculty and staff offices and other locations was completed in fifty-one more buildings with the remainder under construction or scheduled for completion in 1992-3. CWRUnet accommodates a heterogeneous assortment of microcomputers, servers, mainframes, and gateways to other networks, telephones, television equipment, remotely operated surveillance devices, and energy management controls. It is planned to incorporate this campus-area network into a metropolitan area network following the proposed IEEE 802.6 standard. CWRUnet is steadily evolving into one of the earliest implementations of Broadband ISDN. A sophisticated network management system is used to monitor the operation of the entire network.

The CWRUnet project has been carefully documented, and precise costs are known for each element in the network. The data service is presently based on the familiar networking technologies of Ethernet and TCP/IP, and now offers a wide variety of network-based information services to the campus community. The network backbone presently uses 100 M bit-per-second FDDI token ring technology. CWRUnet has been planned to be the essential infrastructure for the University's new Library of the Future. At present, the University's libraries use CWRUnet's innovative CD-ROM jukebox to provide advanced applications of database technology to the campus community.

CWRUnet is an innovation because its existence as a model installation, as well as its successful operation, are changing the way other networks are being planned and implemented; it has established a new level in the "state of the art" and is now leading the way for both commercial and institutional networking facilities.

1. BACKGROUND

Case Western Reserve University is a research university with two residential undergraduate colleges, a graduate school, and six professional schools. It gives the Ph.D. degree in more than fifty disciplines and has a faculty of 1,710, a student body of 8,750, and an administrative staff of 2,270. It is best known for its medical and engineering schools and its polymer and materials science programs; its schools of nursing, law, social work, and management are among the best in the nation. With its extremely favorable faculty-to-student ratio, CWRU undergraduates get unusually fine experiences doing research with the faculty. During 1991-92, the operating budget of the university is $292 million, with over one third coming from sponsored research.

CWRU appointed a new university president in 1987, and accompanying this change were the appointments within a two-year period of several new vice presidents and deans, including a vice president for information services. Together the new management team has acted to develop a new role for information technology in the education, research, and service programs of the University. Central to this new mission is the campus-wide communications network. The University administration has developed planning, implementation, funding, and operating strategies and tactics for the network and has established the implementation project as one of the president's top priorities. Unusual among university CEO's, the CWRU president is championing his second network; the first was at Dartmouth College. The understanding of the implications of this project and the clarity of goals from the organization's top executive has made all the difference in the world in making CWRUnet a reality.

2. REQUIREMENTS FOR THE NETWORK

The new campus-wide network is designed to support a wide variety of academic and administrative applications in all departments of the university, both for today and for tomorrow. The academic applications cover both instruction and research, and for this university, we see these two domains substantially overlapping in many instances.

We believe that communications support to our 13,000 students, faculty, and staff, almost all of whom are "knowledge-based workers," requires the processing of all types of communications media, including voice, video, data, image, fax, and audio. Whereas we need to use these media generally in combination with one another, there are only a few "information appliances" (a.k.a. workstations) currently available that support any multimedia applications. In planning for the network, we needed to insure that the network would support combinations of media at each and every port serving a variety of new information appliances yet to be invented.

A high-speed backbone for a network of the size of CWRUnet seems to be implied. We envision that ordinary computer networking speeds to each desktop, such as ethernet (10 M bps) or token ring (16 M bps), will prove to be inadequate for multimedia communications. If we look at the power of the newest engineering workstations, we see networking capabilities and requirements far beyond ethernet and token ring speeds. Thus, the network for CWRU will have to be able to accommodate this and future generations of microcomputer-based equipment, where each generation is now about two years, and the power of a workstation in the next generation is approximately double that of the current one. As such, we made it a requirement that the network was never to be a bottleneck in the transmission of information from one location on campus to any other location. In practical terms, we understand this requirement to mean that we need an OC-3 speed (155 M bps) backbone now and quadruple that when the network is fully deployed in 1992-3. During the years 1993-95, the backbone speeds will need to increase again to two to four gigabits per second while the primary service rate delivered to each desktop increases to the OC-3 speed to support full multimedia applications. Applications at some desktops will need primary network service rates of OC-12 and OC-24 (622.5 and 1,245 M bps, respectively) for scientific visualization, and the backbone network will be required to handle such traffic without significant delays. With a backbone composed of four dozen strands of single and multimode fibers and expandable with the pulling of additional cable, CWRUnet will initially have an aggregate backbone transmission rate of over 200 gigabits per second.

A major application being developed at Case Western Reserve University in conjunction with CWRUnet is the electronic "library of the future." Although it will take many years for the University's largely paper-based collection to be transformed to a digital format, much information is presently available in digital form and otherwise available for transmission over our campus network. To make still more progress in this area, we are collaborating with the IBM Corporation to build an image collections server, which will be operational in a prototype form in 1992-3. The campus-wide network will be ready to receive the tremendous loading of information which the image system will provide to campus users. In addition, we have a project nearing completion which is developing an automated jukebox of CD-ROM platters as yet another networked information resource. The CWRU CD-ROM collection holds the equivalent of about 16,000 books; its holdings range from the complete Oxford English Dictionary and the Grolier's Encyclopedia to numerous reference data bases for chemical compounds and molecular structures. Over one hundred thousand book-equivalents in the digital format of CD-ROMs are being acquired by the University Library each year. The clear advantage of the CD-ROM is that in this format the data are capable of being searched by a computer, and with the networked CD-ROM server, the user may do the searching from his/her workspace without necessarily having to go to the library.

Electronic mail capabilities are important network services for this university community, especially as it connects students to each other and students to both faculty and staff. The CWRU electronic mail system must serve the entire 13,000 person campus community and must have linkages to networks beyond the campus, and there must exist the capability to send and receive fax's through the electronic mail system in an integrated manner. In addition, the network must have electronic bulletin boards, which will contain a variety of useful information for students, faculty, and staff, including course syllabi, course-specific homework assignments, and last semester's exams which students may use. The network will have to accommodate more than three hundred other moderated bulletin boards providing information about and for the greater Cleveland community.

The network must be a vehicle to offer other information services as well, including being able to provide software to our user community. Our vision here is that standard "commercial" software is made available without charge to students, faculty, and staff from the network-based software library, including a variety of word processors, spreadsheets, symbolic and numerical mathematics tools, graphics and statistics packages, and data base managers. "Courseware" is also distributed from the software library over the network.

Another fundamental requirement for the network is that it fit into a metropolitan area network grid to connect the campus to many off-campus locations, including the homes of our faculty, staff and graduate students (our undergraduates live mainly on-campus). In addition, the network will have to be connected to off-campus hospitals and other health-care facilities, to businesses that want to receive our continuing education offerings, and to other educational institutions in our region because our campus libraries share their holdings with the major regional academic and research libraries. Other network connections will reach beyond the campus to statewide (OARnet), national (NSFnet and NREN), and international (BITNET) networks. Thus, all of the citizens of the university will be able to maintain electronic relationships with their peers at other major centers of scholarship. The network must be able to provide connections to many off-campus systems, including specialized compute engines for computer-assisted design, for supercomputing, which is a free resource for our students and faculty, for hosts of research software systems in artificial intelligence and expert systems, and for off-campus information services, such as Mead Data Central's Lexis and Nexis systems and the United Press International newswire, which is a constantly updated news wire service continually feeding its information products to the campus community via CWRUnet. Lastly, network users will need to have access to highly versatile laser printers in selected locations around the campus. These printers will be free for most uses.

Taken together, the requirements for the Case Western Reserve University network are demanding, but they are not substantially different from what we expect to see in general business use in the twenty-first century. Giving our students the experiences of learning with the "network of the future" on the campus of CWRU today will give them excellent preparation for careers in business and government and in other walks of life.

3. INNOVATION

Transmission of arbitrary collections of multimedia documents is a prerequisite to achieving our ultimate goals. A digital representation of all information formats makes it possible to use a common transmission facility, and fiber optic cabling with associated optoelectronics is the one medium that has the bandwidth for present and future applications. With this imperative, Case Western Reserve University has committed to implement an eight thousand port network in four phases. Phase I with 1,861 ports was implemented and made fully operational during 1989. Phase II used the identical design for 1,703 ports and was made completely operational just before the end of 1990. Phase III with 2,440 ports was implemented during 1991. Phase IV with 2,000 ports is presently under construction.

CWRUnet was developed from a strategic planning process that considered a comprehensive array of potential uses for the network in the university and from a vision of what could be done with available, "off-the-shelf" technology. Although there are other "fiber-to-the desktop" systems in existence, CWRUnet is the first to use only fiber optic cabling for data transmission; this includes the use of fiber strands in all premise wiring and in all backbone cabling. In addition, all of the interfaces for a wide variety of brands of microcomputers use only fiber from the computer's backplane via optoelectronics and a fiber jumper cable to the network's wall outlet (faceplate). CWRUnet is an "open network" because it uses the industry standards of ethernet and of TCP/IP and presently accommodates on the basis of "plug-in and play" a heterogeneous mix of personal computers, workstations, servers, shared computers, and gateway devices of other networks.

CWRUnet is presently unique because it uses both single mode and multimode fiber in the premise cabling and in the backbone cables. With two pairs of single mode fibers in the premise wiring to every faceplate, the practical limit in information distribution with CWRUnet, using available optoelectronics, is presently over sixteen gigabits per second to each desktop! That speed is fast enough to transmit the entire Library of Congress to each user in less than one minute; it is also an order of magnitude faster than a pair of human eyes can take in information by way of the optic nerve. As it is designed and implemented, it is easily copied because it is made of only "off-the-shelf" components.

When designing CWRUnet, we built a high level of network management capability into the project. We set as a goal to be able to "see" each attached "information appliance" and all in-line optoelectronics from a central campus network operations center. If a device malfunctions, the unit can be disconnected from the network control center rather than from its specific location. The implications of this are economy of staffing, surveillance of the operating network, and operational segmentation of the troublesome unit from the rest of the network. Repairs may involve a "house call" but that can be a scheduled event. The network management system collects operational statistics which can be used by the system's managers to improve network performance.

CWRUnet is an innovation because its mere existence in a fully operational state is changing the way other network managers are thinking about implementing or upgrading their systems. Network planners will have to consider the use of fiber optic cabling in the premise wiring; they cannot dismiss this possibility because CWRUnet is operational today. Most importantly, strategic thinking can work successfully in implementing a major communications facility for a company or an institution. The CWRUnet project is a successful case study of what can be done with careful planning and analysis; it is a model installation.

4. STRATEGIC PLANNING AND THE PROTOTYPE

Building a communications network of the size and scope of CWRUnet is a strategic project, and planning for the network was undertaken after a networking strategy for the University was developed. One of the important conclusions of the strategic plan was that the use of fiber optic cabling as premise wiring was inevitable. The question then became one of estimating when it would become the default choice for premise wiring, as it had already become for backbone cabling. We decided to ask the experts in the laboratories of the leading communications companies; their experiences were very enlightening and encouraging. We called vendors of fiber cabling to ask about costs, and they were also extremely helpful and provided the information we needed. We built a prototype of a 100% fiber optics network which taught us about connectors and other components that were part of a complete network installation.

Some of the University's key networking personnel had learned from other network projects at other universities that labor costs are a dominant component in the wiring of entire buildings. After consulting with various electrical contractors about the effort needed to wire (i.e., retrofit) older buildings, we became convinced that because of the cost and disruption involved, we could afford to wire the campus' buildings only one more time within the next thirty-to-fifty years, except for the situation where a building unit had to be extensively renovated. Labor costs can be expected to increase over time; thus, future wiring projects will have higher costs than present ones. Because we planned to use the fiber optic premise wiring immediately, we did not make a countervailing strategic funds management argument regarding the wisdom of allocating assets (the cost of the fiber) to only future use, and the loss of the use of the funds (and possible income generated by these funds) used to purchase the fiber.

The next immediate issue was considering how to make the premise cabling independent of the optoelectronics. We recognized that the fiber could be used for many years, certainly over twenty, but the optoelectronics was being improved significantly yearly. These improvements were a natural process in the technologies that build upon both integrated circuitry, where no plateau was going to be reached in any foreseeable time, and software, which was driving the operation, control, and management of networks. In the future, it is likely that software will provide networks the functionality that will be needed, thus making upgrading easy relative to replacing the electronics hardware which requires more physical coordination and management and should be done only when it is needed. We concluded that we would want to institute a continual upgrading process for the optoelectronic components by changing them every five years on average or when a user needed the upgraded services. This strategy would work well only if these network components could be made independent of each other.

5. THE NETWORK CABLING ARCHITECTURE

CWRUnet has been built upon a cabling architecture that accommodates the University's strategic vision of the need for both single mode and multimode fiber optic cable in both the backbone and the premise wiring. It also recognizes the vision of a wiring plant that is comprehensive and flexible as to its uses. The architecture also fulfills the requirement for wiring buildings only once more, a so-called "wire-once cabling architecture." Because the wires are to be independent of the electronics, upgrades are made only to the electronics, and as often as user requirements dictate.

The cabling architecture used is hierarchical - in three levels. We adopted as a critical design principle that all types of premise wiring (level 3) were to be run together in common conduits and that the premise cabling would be deployed radially from "wire centers" in each building. Each wire center would be connected over the backbone cable (level 2) in a hierarchical fashion to an even larger concentration or "wiring hub" (level 1). A wiring hub typically serves a cluster of buildings. One of these hubs, physically near the center of campus, is currently viewed as the central control hub, but this relationship will change as an alternate site is established for continuity/recovery in the event of a local disaster. All of the hubs were to be interconnected to each other using redundant paths that would crisscross the campus in a suitable topology. We left it to our contractors to propose the exact arrangement of hubs and the particular physical network topology for our campus.

The "star wiring" and hierarchical premise wiring design adopted in CWRUnet makes each network port within a building wiring center independent of every other one, so it is possible to change the network services to an individual port without changing anything else. In this way, the "wire once" philosophy was justified. Independence of cabling and equipment was considered vital. Economics demanded the wire-once strategy for cabling, but CWRU recognized that equipment available to support its evolving needs would change with those needs. Other forces of change at work were the progress of technology to support new communications functionalities and to reduce equipment costs at the circuit level.

The Phase I implementation project built three hubs to serve the portions of the campus being wired at that time. Phase II added three more hub locations and put in the redundant conduits to connect each hub to at least three of its immediate neighbors. This backbone cabling consists of 24 strands each of multimode and single mode fiber and is routed through conduits which were installed mainly in existing steam tunnels; some new underground construction of dual four-inch diameter pipes was required. There is also one aerial span which crosses railroad tracks. With the hierarchical physical network topology it is possible to configure and reconfigure the logical network to support ring and point-to-point network topologies, in addition to discrete stars, by changing the equipment and the fiber patching in the hubs. Each of the hubs serves six to thirteen buildings, with star connections consisting of 18 multimode and six single mode fibers, capable of re-patching to support multiple logical network topologies. The network control center is housed in adjacent space to one of the network hubs; a redundant control center will be constructed and equipped for implementing a recovery from a physical network "disaster."

To provide the network services which were required immediately, data, voice, and video, at each and every faceplate, we assessed the practicality of using only fiber optic cabling in the premise wiring. If we had implemented such a plan, we would have found the cost of delivering telephone and television services to be very high because of the costs of connecting standard television and voice instruments directly to fiber cabling. Many networks are being built with fiber cabling used only in the backbone and with copper cabling, for example unshielded twisted pairs (UTP), as the premise wiring. At CWRU we inventoried our buildings and found little or no unused UTP; we had no other choice but to pull some new premise wiring. Clearly, we would probably have postponed the use of fiber cabling in the premise wiring if we had found such unused capacity available.

The primary user interface to CWRUnet is through a faceplate, an analog of the electrical wallplate. The premise wiring is terminated at each faceplate. Like electrical service connecting an appliance to the wallplate, there is a network "jumper" cable which is needed to connect each terminal device (phone, TV, computer, etc.) to the faceplate. Each faceplate is served by the CWRUnet "standard" premise cabling which is a composite of four strands of 8.3/125 micron single mode fiber, two strands of 62.5/125 micron multimode fiber, one RG-59 coaxial cable, and 4 unshielded twisted pair 24 AWG copper cable. The composite cable was constructed by Siecor as a custom product; the fiber products are made by Corning. As a aside, we note that the coaxial cable was pulled alongside the main cable so as to limit the size and complexity of the composite cable. Because of structural conditions in our buildings, horizontal surface raceway ("wiremold") or in-wall conduiting was used to protect the premise cabling from future wear and tear and from penetrations of the walls as a normal byproduct of customization of these living and working spaces. The vertical conduit paths were custom designed to fit the interior of each building. Premise cabling conduits were placed in existing "risers" where they had sufficient space; otherwise, new risers were built. The cable raceway uses common paths in the risers and as far as possible in the horizontals to minimize the amount of raceway, but each faceplate is served by separate cables in the raceway.

In a project of the scope, complexity, and strategic nature of this one, adherence to standards and emerging standards was considered to be of extreme importance. This dictated the choice of fiber size, specifications and connector type (ST), the decision to provide 8 conductors of UTP connected to an RJ-45 (which is fully compatible with ISDN services), and the termination arrangements for the cabling. Ease of administration added to the standards-based case for designing a single equipment room in each building, whether hub, premise, or both. The concept of "logical" buildings within a physical building was used in exceptional situations to reduce the quantity of costly premise cable and raceway. The structure supporting cable terminations, patching and equipment installation in each equipment room, consists of standard racks, patch panels, molding, foam padding, etc., designed entirely from off the shelf components, was engineered to accommodate CWRUnet's cabling architecture and provide space for both current and planned equipment.

Multimedia communications are central to the vision of CWRUnet services. Today's equipment does not support multimedia signaling integrated in a manner suitable for CWRUnet. It can be supported, however, by parallel cable paths of discrete media for voice, data, and video. CWRUnet was designed to follow this approach until emerging standards and equipment technology advance to the point that fully integrated signaling is practical and cost effective. When this happens, discrete signaling over separate media will be discontinued, and the unneeded media will be abandoned or used for some other communication which does not need to be integrated.

We considered building a formal cost model to justify our decision to use fiber cabling as the principal premise wiring as opposed to using unshielded twisted pairs. We abandoned this effort when we realized that the applications we wanted to develop and distribute using the network would likely require higher transmission speeds than we could safely say that copper cabling could support, and even if the copper cables would be usable, the cost of the electronics and the complex compression software that might be required could be very high. In the end, we could imagine enough cross currents in the trend lines over time to make the "conservative" decision to deploy fiber cabling at this time, which is what we did.

With our informal justification argument being somewhat neutral or ambivalent for or against the use of any one premise wiring cable in relation to the cost of the project, we realized that the University could market itself in a distinguishing manner by being the first university to implement a 100% fiber optic network. Clearly, one of the major telecommunications common carriers was using this difference to good advantage. In the end, the University administration was able to argue persuasively that the technical risks in the project were manageable, the short-term premium costs of fiber optics were tolerable, and the University's image could only be improved if the 100% fiber optic network actually was implemented on schedule.

6. NETWORK CONSTRUCTION

The University implemented the new network by contracting with TRW and JWP Information Systems to design and construct the system. These firms were selected after a complete Request For Proposals (RFP) and competitive bid process was undertaken. The University developed the RFP internally; this document delineated a set of design principles that each proposer was to follow. Specifically mandated in the RFP was the appropriate use of fiber optic cabling to every wallplate (i.e., desktop).

The University received seven responsive proposals from the leading telecommunications vendors in the United States. Each proposal was evaluated by at least three reviewers. A systematic rating score was developed for each proposal with the technical portion receiving about 70% of the weighting and the cost elements the remaining 30%. Two quite different proposals received nearly identical weighted scores. These two vendors were invited to update their proposals and a final evaluation was conducted. The winning proposal was submitted by TRW and Robbins Communications. The University negotiated and then entered into a contractual relationship with TRW as the prime contractor and systems integrator and JWP as the prime subcontractor, designer, and builder of the fiber optics network.

Before implementation of CWRUnet could begin, several issues were addressed in "engineering" how CWRUnet would be installed. These related to the fast-track schedule required to meet the completion deadline, and the need to provide for future expansion of CWRUnet services.

A number of electrical subcontractors were engaged by JWP to dig trenches and core drill the various buildings and to do many other construction tasks. Structures to support, protect, and conceal the premise cabling were built. Wiring centers to consolidate the cabling and to house the active optoelectronics were also constructed. For example, faceplate acquisition involved reconciling issues of cost, availability, and esthetics. The eventual faceplate selected was a standard part, re-engineered to our specifications, and "finished" with a high quality label for identification and protection from tampering.

Termination of the premise cables raised both technical and time issues. From a technical standpoint, the issue was how to terminate the fiber strands. The time issue was the large number (over 20,000) of terminations to be performed in a tight schedule, an elapsed time measured in only a few weeks. After careful consideration and cost analysis, we decided to have the premise cables prefabricated with connectors at the faceplate end, and pull the cables "backwards" from the faceplate to the equipment room. This overcame the technical problem of field termination of multimode and especially single mode fibers in numerous, rather awkward locations. Special practice was developed for equipment room termination of the multimode fibers, and storage of the as yet unterminated single mode fibers, and provision of hand-on training enabled us to handle the premise fibers in the equipment rooms within the time constraints. Significant time savings were achieved in the installation of faceplates by eliminating the time required for field termination at faceplates. Testing and rework time was also reduced because of the higher quality of the factory terminations.

Provision for the future of CWRUnet meant ensuring that cabling unused in the initial implementation could be placed in service easily and without cost penalty. For this reason, all of the premise and backbone multimode fiber strands were terminated and installed in termination bay patch panels, providing maximum protection for the unused fibers and taking advantage of the productivity value of terminating these fibers all at the same time.

Treatment of single mode fibers in the premise wiring differed because the in-service date for this fiber was indeterminate. Two of the fiber strands at the faceplate were terminated as part of the prefabrication process to avoid the future problem of terminating these at their separate locations. Two additional single mode strands were coiled and stored in the faceplate because they might never need to be used and the termination cost never incurred. All of the premise cable fiber ends in the equipment rooms and all of the backbone single mode fibers were prepared for future service by placement in splice trays within splice bays. When these are required for service, factory pigtails will be fusion spliced to fibers already prepared for this. Blank patch panels to accommodate these terminations are already installed. As a result of this engineering and installation practice, it is possible to place additional multimode strands into service within a matter of minutes and single mode strands within a few days.

Central to the physical architecture of the communications network is the building equipment room. All of the optoelectronics is housed in these rooms. The Phase I project designed, engineered, and constructed 25 rooms. Eventually, some 90-plus rooms will exist in the 85 buildings on the CWRU campus. CWRUnet depends on the faceplate for network service delivery to be an invariant entity; it is the equipment room where the network service is defined through hardware and software subsystems. A rack/cabinet and wall mounting system for cabling and equipment was developed and put into full operation, although some of it will not be used until the future as CWRUnet services are expanded. These racks and cabinets are all standard products and components. One of the biggest challenges in this domain was the development of overall building space requirements for now and the future, designing the most convenient layout for splice bays, patch panels, equipment, etc., and doing this within physical limitations of rooms that could be made available for this purpose. With our designs, we selected components, from racks and fiber storage cabinets, to molding for the routing of patch cables, foam rubber padding for the cable tray supporting the cable as it entered the room, clamps to secure the fiber entering the cabinets, and labels which would identify each cable, fiber strand, coax, and twisted pair. Building prototypes helped us to refine the design and engineering until we were satisfied that the cable and equipment mounting would satisfy the twin issues which we faced.

Underlying these implementation issues was the goal of making it easy to administer CWRUnet's cabling and change the equipment over time. For the fiber optic cabling, this was achieved through a combination of the use of fiber optic patch cables (jumpers) for all of the cross connections, patch panels which are easy to access when open but tightly secured when closed, and careful labeling of all cables and connectors. Connection to equipment is by the same jumpers, and all of this equipment is mounted in standard size racks and cabinets, with standard rack mount shelving available to accommodate any equipment of non-standard width.

Unanticipated problems were a part of the installation in this project. They ranged from asbestos contamination, blocked conduits, and supplier delays to slow adhesion of faceplate labels in the high summer heat and humidity and blocking of access to an installed but untested faceplate by a returning student's waterbed.

The entire Phase I project was carefully planned and managed, so that the active construction period for all 1,861 faceplates, the backbone, and all other network structures was only ninety-four working days. At peak periods, over one hundred people were working simultaneously in twenty-six campus buildings. Sounds emerging from the tired but triumphant installation team on August 25, 1989, when the first student successfully used CWRUnet and September 1, 1990, when the entire Phase I network went live, were a mixture of hearty cheers and sighs of relief. All of the design, engineering, and installation practices developed for Phase I were followed in Phases II, III, and IV because they proved successful and cost-effective.

We have created a map for others to follow, through the previously uncharted territory of major, fiber to the desktop campus networks.

7. COSTS AND BENEFITS

Costs

For the Phase I project involving 1,861 network ports, the total cost was $4,427,617, an average of $2,379 per port. This figure is inclusive of all costs. Experience in Phase I has shown that for Phase II reductions were achievable. The average cost for the Phase II project was reduced to an average of $1,942 per port, based on 1,703 ports. A breakdown of the Phase II average cost in terms of its constituent elements is given in Table 1, together with percentage figures. Further cost reductions were achieved in Phases III and IV.

The figures in this table are expressed in terms of each network port or faceplate, the outlet at each desk, which is the primary connection point of the network. These cost figures, however, include the photonics and electronics, PC adapter cards for ethernet or token ring, and "jumper cables" necessary to connect a standard microcomputer to the network faceplate, including IBM compatibles of almost all types and Apple Macintoshes from the SE to the IIci and a variety of UNIX workstations. Thus, these figures are all inclusive.

A second cost analysis was undertaken: whereas we had been told at the outset of our planning that the relative cost elements of the network would be very high for fiber optic cabling and optoelectronics, we suspected that the labor costs would turn out to be the dominant amount in the project. Table 1 shows the break down of costs for the elements of labor, materials, and optoelectronics as actually experienced in Phase II. Direct project labor was nearly 40%, with the other two components at 30% each. Thus, these data forecast that fiber optics networks built in the future will, in all likelihood, cost even more than CWRUnet because labor costs will continue to increase even if optoelectronics costs drop substantially, which they should do. Materials costs will probably remain at the level they are now because some components will go down in cost while others will increase.

Throughout the construction, the University kept track of all of the elements of the project with computer-based drawing packages (e.g., AutoCAD) and data bases for all faceplates, equipment racks, etc. A photo album of significant installation events has over three hundred pictures in it. These records of the construction will be maintained and used as part of the University's network management function. Changes to the network will be planned using this computer-based information. This time, the "shoemaker's children" are not going barefoot.

Benefits

CWRUnet has been operating continuously since August 25, 1989. It provides connections between end-user microcomputers and a variety of on-campus and off-campus information services, including electronic mail and bulletin boards, the library's on-line catalog system, several software library servers, the CD-ROM jukebox, a variety of shared computers - all on campus, and the Cray Y-MP/864 and Mead Data Central's Lexis and Nexis Information Services off-campus. Students and others are routinely checking both local and national news through the UPI newswire feed. CWRUnet also is connected to regional and national networks providing communications linkages to other universities and centers of scholarship and commerce. During 1991-2, CWRUnet added commercial cable television services; now students are view cable television in their rooms and faculty can add television-based information to their lectures and seminar sessions. As supporting infrastructure, CWRUnet is proving each day that it helps users get to the information they want and need, that it is dependable and straightforward to use.

As more and more devices are attached to CWRUnet we are finding all the hardware and software components we need to provide this essential connectivity. We believe that these products exist and are available in the commercial marketplace because CWRUnet is built upon well known standards, such as IEEE 802.3 ethernet at ISO layer 2 and TCP/IP at layers 3 and 4.

Even at this early time as we are near the end of the third year of operation, students, faculty, and staff are finding more and more uses for the network and requests to be connected are increasing since realizing the value of sharing information and developing new relationships across the network. This is why the University is investing so much in this infrastructure.

8. ASSESSMENT OF CURRENT OPERATION

Our contractors, TRW and JWP, understood the goals and objectives of the project from the earliest stages. Their insights, creativity, and experience coupled with determination to succeed have made the construction and the operation of CWRUnet a "Case Study" in how to do a "fiber-to-the-desktop" project. All of the project goals have been achieved. Time and cost budgets were met in Phase I. The Cabletron network management system, Spectrum, with graphical "iconic" controls is fully functional.

9. PLANNED ENHANCEMENTS

CWRUnet is planned to have about eight thousand network ports in eighty-five buildings. During 1989-91, the University wired some sixty-seven buildings with over seven thousand ports. During 1992-3, the remaining ports will be installed in buildings not yet wired.

The next network project is to extend CWRUnet off-campus following the standards delineated in IEEE 802.6 Metropolitan Area Network. Connecting CWRUnet to the university-affiliated hospitals and to the many businesses that participate in our Instructional Television Network will be a great step forward. Again, our vision for the network is that it connects people and that it provides a variety of information resources that support education, research, and service to our community, the region, the nation, and the world. Case Western Reserve University really believes that the CWRUnet network will made a substantial contribution to fulfilling its central purpose.

Another phase of the expansion of CWRUnet will bring it to the homes of our faculty and students who live off campus. The technologies to do this are still emerging from the development labs, but we know that ISDN telephone service will not be the vehicle for the expansion of CWRUnet. Our interests are more along the lines of the emerging technologies for Broadband-ISDN.

We see the future as having a basic service transmission rate of 155 M bps (OC-3) into each work space, but even that rate cannot provide all the services we would like to see develop. Is it too much to wonder when, not if, multigigabit per second service will be a standard utility in every home and office, each place of business and every institution? CWRUnet has established the fundamental wiring plant to support experiments and the development of prototypes for the telecommunications future. Thus, the University is planning to exploit this new capability. It will be reporting on the results of this work in the years ahead.

10. CONCLUSION

Case Western Reserve University has finished successfully three phases in an effort to build a major fiber optics-based communications network for its campus. The new network can handle a comprehensive offering of services, including voice, video, data, telemetry, and control signaling. Unlike other networks, CWRUnet takes both single mode and multimode fiber cabling all the way to the desktop. The network can accommodate a wide variety of end-user devices as "information appliances." The network wiring is independent of the operating optoelectronics, and thus, each can evolve independently of the other. The network is built of all off-the-shelf components, including an advanced network monitoring and management system. CWRUnet has been designed to become part of a larger Metropolitan Area Network following the IEEE 802.6 standard. As a high priority, strategic project of the University, it has consistently received the enthusiastic backing of the University community.

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How Important is Data Quantity and Quality at Your Institution?

Sharon Setterlind
Eckerd College

HOW IMPORTANT IS DATA QUANTITY AND QUALITY AT YOUR INSTITUTION?

Sharon R. Setterlind
Director, Computer Center
Eckerd College

Introduction

A major trend in computing today is to utilize existing data from a database system in support of decision making. Because a database application relies heavily on a continually changing pool of data, it is essential that the data quantity and quality be consistent. Continued growth, the constant internal and external factors that force changes, and the sophistication of end users over a period of time, all work to have a severe impact on the administrative database system.

Background

Eckerd College, formerly known as Florida Presbyterian College, is a coeducational college of the liberal arts and sciences located in St. Petersburg, Florida. The school was founded in 1958, and it is related by covenant to the Presbyterian Church.

Eckerd College purchased a relational administrative software package in December, 1981. Implementation began with vendor support; but when the vendor filed for bankruptcy, the task was handled internally by the Computer Center personnel. During this initial installation and implementation phase of the administrative database system, guidelines and procedures met current needs. The people responsible for the 'setting up' of the system prepared the process with current information available and the database reflected the way that the organization was currently doing business.

In the spring of 1990 the Computer Center at Eckerd College developed a formally structured process to record requests for changes through an on-line work request module. Through these requests, the Computer Center Director gradually realized that implementation was incomplete in the modules of the application software package and that many modules were not being utilized to their fullest potential. Many users had experienced problems that could have been avoided given lines of code or a simple explanation of particular features of the software.

As the problem of an incomplete implementation became more noticeable and departments were demanding assistance in generating reports to provide decision support for upper management, the Computer Center Director decided to research the problem through a complete systems analysis of the administrative database. The research performed was an intensive study into the database quantity and quality of the integrated relational database system of an application software package. Problems researched were data usage, and incentives for further development.

Design

The research design was a multiple case study approach (module by module) of the database system. Because of the structured interviews, an embedded design was used to examine the sub-unit variables of programs, tables, data fields and incentives for further development of usage. Due to time constraints the entire unit of analysis (18 installed modules) could not be conducted and a pilot study of one module (Admissions) was performed.

Subjects

The subjects in the study were the three employees of the Admissions office of Eckerd College who were responsible for input and output of information to and from the database system on a daily basis. The same three employees were involved in the procedure to gather data on database usage, and incentives for further development of the database system.

Instrumentation

Instrumentation in this research study was a structured interview process using three tools developed and designed by the researcher. The first tool was the Module Review Form (Appendix A) used to gather data on database usage.

The second tool was a writing technique, Playscript (Appendix B) that was used to gather information on office procedures. The third tool was a Questionnaire (Appendix C) that was a collection device for gathering information for incentives for the further development of database usage of the database system.

Procedure

The two sources of evidence used in data collection were the structured interview process to determine usage, job functions, and incentives for further development of usage; and the documented programs and the data dictionary that indicated how the programs, tables and data fields were designed to be used in the database system. Each user was interviewed separately and the Module Review Form was used as the researcher gathered the information by handwriting the responses and taping the sessions.

The researcher selected a sample of responses from the Module Review Form to place the data in categories for the responses to be judged. The transcribed responses, the documented programs and data dictionary, were submitted to three judges along with an explanation of the four categories. The judges were asked to read the responses, compare the responses with the documented programs and the data dictionary, and place the appropriate circled category on the document. When this was completed the researcher entered the circled responses into an IBM compatible computer using SPSSx software for statistical crosstab analysis.

The researcher conducted interviews with the office manager of the Admissions office and used the Playscript procedure during the interview process to determine a chronological order of a job function from beginning to end. The researcher gathered the information by handwriting the responses and taping the interviews.

The third interview process was conducted after the data on database usage was analyzed. The purpose of this exercise was to gather information on incentives to increase usage of the database after discussing the actual usage from the study. Each user was interviewed separately, then together, and the Questionnaire was used by the researcher to handwrite the responses.

Results

Module Review Form: The data collected from the Module Review Form was coded into four categories. The database elements listed for utilization were 28 programs, 40 tables, and 214 data fields for all three subjects. The categories, as shown in Table 1, were used for each database element.

Category 1 indicated that the subject used the particular feature of the software and that he/she used it correctly. Category 2 indicated that the subject used the particular feature of the software but that he/she used it incorrectly. Category 3 indicated that the subject did not use the particular feature of the software but that he/she understood how the particular feature should be used. Category 4 indicated that the subject did not use that particular feature of the software and that he/she did not know how the particular feature should be used.

Table 1.

Module Review Form Categories

CATEGORY	USE	HOW
1	Y	CORRECTLY
2	Y	INCORRECT
3	N	KNOWN
4	N	UNKNOWN

TABLE 2.

SUBJECT 1 - RESPONSES TO MODULE REVIEW FORM

CATEGORY	PROGRAMS	TABLES	DATA FIELDS
1 Y/CORRECTLY	12 (42.9)	12 (30.0)	113 (52.8)
2 Y/INCORRECT	0	0	0
3 N/KNOWN	1 (3.5)	15 (37.5)	54 (25.2)
4 N/UNKNOWN	15 (53.6)	13 (32.5)	47 (22.0)
TOTAL	28	40	214

* Numbers in parentheses represent the percentage of usage of the database elements

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TABLE 3.

SUBJECT 2 - RESPONSES TO MODULE REVIEW FORM

CATEGORY	PROGRAMS	TABLES	DATA FIELDS
1 Y/CORRECTLY	5 (18.0)	11 (27.5)	99 (46.2)
2 Y/INCORRECT	0	0	0
3 N/KNOWN	0	9 (22.5)	38 (18.0)
4 N/UNKNOWN	23 (82.0)	20 (50.0)	77 (35.8)
TOTAL	28	40	214

* Numbers in parentheses represent the percentage of usage of the database elements

TABLE 4.

SUBJECT 3 - RESPONSES TO MODULE REVIEW FORM

CATEGORY	PROGRAMS	TABLES	DATA FIELDS
1 Y/CORRECTLY	8 (28.5)	11 (27.5)	98 (45.7)
2 Y/INCORRECT	0	0	0
3 N/KNOWN	1 (3.5)	4 (10.0)	27 (12.6)
4 N/UNKNOWN	19 (68.0)	25 (62.5)	89 (41.7)
TOTAL	28	40	214

* Numbers in parentheses represent the percentage of usage of the database elements

TABLE 5.

SUMMARY OF USAGE BY CATEGORY BY SUBJECT

DATA ELEMENTS	Y/CORRECTLY	Y/INCORRECT	N/KNOWN	N/UNKNOWN
PROGRAMS	SUB1 (42.9)	0	SUB1 (3.5)	SUB2 (82.0)
	SUB3 (28.5)	0	SUB2 (0)	SUB3 (68.0)
	SUB2 (18.0)	0	SUB3 (0)	SUB1 (53.6)
TABLES	SUB1 (30.0)	0	SUB1 (37.5)	SUB3 (62.5)
	SUB2 (27.5)	0	SUB2 (22.5)	SUB2 (50.0)
	SUB3 (27.5)	0	SUB3 (10.0)	SUB1 (32.5)
DATA FIELDS	SUB1 (52.8)	0	SUB1 (25.2)	SUB3 (41.7)
	SUB2 (46.2)	0	SUB2 (18.0)	SUB2 (35.8)
	SUB3 (45.7)	0	SUB3 (12.6)	SUB1 (22.0)

* Numbers in parentheses represent the percentage of usage of the database elements

Playscript: There are 12 major functions in the Admissions office and for the purpose of this study the job function 'Applicant Processing' was used to illustrate the Playscript procedure for writing office procedures.

A major portion of the 'Applicant Processing' function is to type out a 'white card' to accompany all application forms. This 'white card' is then entered into the database and placed in a box (alphabetically) and set on a table where all Admissions personnel have access. Any and all activity, as it occurs, (such as, received transcripts, and test scores) for the applicant is hand written onto the card and then submitted for data entry. At any point and time the Admissions personnel are able to review the 'white card' and see all the information they need on the applicant.

Questionnaire: The common trends of the responses to the Questionnaire were as follows:

1. What in your opinion are the strengths of the Admissions module of the administrative software package?

  * provides a dependable letter flow process
  * provides good status information important to the admissions process
  * provides historical information on students

2. What in your opinion are the weaknesses of the Admissions module of the administrative software package?

  * not using the module to fullest potential
  * slowness of system causes delays at entry time
  * frustration on going back and forth between the files

3. What contributing factors would you say are the reasons for the under-utilization of the Admissions module of the administrative software package?

  * not knowing the capabilities
  * only do what is needed because of time
  * good client unique programs written

4. What would you say needs to be done by the Computer Center to make better utilization of the Admissions module of the administrative software package?

  * anything to save time
  * programming of existing standard reports and letter program to current needs
  * training for new capabilities

5. What would you say needs to be done by the Admissions Office to make better utilization of the Admissions module of the administrative software package?

- learn full system to use full capacity
- implement new office procedures
- training on new ways to send/receive information
- allow more users time for training
- new equipment (terminals/printers)
- additional personnel (data entry/asst for Dean)

6. What would you say are the barriers to accomplishing the responses of questions 4 and 5?

- funding (equipment and personnel)
- time to work out new procedures
- fear (anxiety) of losing personal touch
- learning new system - not sliding back to old ways
- Computer Center not having resources for programming and training

Interpretations

Database Usage: The results strongly indicated that the database elements were under-utilized but that all of the data elements in use were being used correctly. The results indicated also that not one computer user (of the three computer users) in the Admissions module knows the entire system, although one user knows it better than the other two.

The highest percentage of unused data elements were not currently being used because the computer users did not understand how these particular features of the software were to be used. This does not necessarily imply that these data elements would be used if known; as the percentage of "not used but known" increased as the knowledge base increased.

The programs (by percentage figures) were the least used data element. This is not unusual because the programs that Admissions uses to process letters and reports are client unique (specific to Eckerd College) and therefore they do not use many of the base system programs. These client unique programs were written at the time of installation when the vendor declared bankruptcy. The vendor's insolvency became a major problem for effective implementation.

Tables (by percentage figures) were the second least used data element. Tables are 'shared' across the database system. Since Admissions is the first module, many tables that service other modules were established in this module. A newer revision (November 1990) of the administrative software package moved 17 of the 40 tables to other modules across the database system. Research to determine what impact this would have on usage in the Admissions module has not been conducted.

The data fields (by percentage figures) were the most used of all the database elements. Again, because Admissions is the first module and data fields were also 'shared' across the database, many data fields begin in the Admissions module. The data fields that were being used in the Admissions module were fulfilling their current needs as they utilize these data elements to process letters and reports daily.

Office Procedures: As the researcher and the office manager of Admissions stepped through a chronological order of the job functions, it became increasingly clear that the processes were full of redundancies and time consuming. Also in many incidents the workings were hindered by the lack of knowledge on how the computer system could streamline the process.

In the case of the job function 'Applicant Processing', it was redundant because: 1.) the data is typed twice, once on the 'white card' and then in the computer; and 2.) all received information is hand written on the 'white card' and then entered into the computer. Problems arise when one person removes the 'white card' from the box for reference and another person requires its use. At the end of the day the 'white cards' are re-filed.

Incentives: The results from the Questionnaire indicated that although the computer users in the Admissions office were aware that their current operation was outdated and in need of change, they were concerned about total dependency on the computer system (elimination of 'white cards') because of the slowness of the system and any emergency 'down time' that might occur. They have come to value their current methods, and they were concerned about losing the 'personal touch' that access to immediate information ('white cards') has provided them over the years.

The Admissions computer users were aware that they were not using the system to its fullest potential. Since the applicant pool of students (domestic and international) has grown substantially over the years, the client-unique programs need to be re-written to service current and future needs. Because the client-unique programs (letters and reports) have been dependable in the past, any revisions must be made as transparent to the Admissions Office as possible.

Many of the unused data fields are needed by other database modules. As the end users of these modules become more sophisticated, they are pressing for their inclusion in the Admissions module. The end users of the college are developing an active concern for database integrity and sharing across the organization.

Office procedures (the 12 job functions) require intensive evaluation, design and planning to make them more efficient and effective for day to day operations. A resistance to changing the office procedures stems from the fact that the current database system does not provide the Admissions Office output (print-outs and screens) information that is acceptable to the way they do business.

Another area of concern is the valuable resource of time and personnel that will be needed to learn the new features of the existing system and any new processes that arise from changing and implementing new office procedures (the applicant processing is an example of this). This valued resource of time and personnel also will have a direct effect on the Computer Center (programming, documentation, training).

As the Admissions Office becomes more dependent on the computer, more personnel, not just the three current computer users, will require access to terminals and printers. Additional personnel will be required to handle the demand of data input if an increase in data fields is needed. This is due to procedural changes and the insistence of users campus wide. The demand on the Computer Center for programming, training, and documentation also will increase. Funding for the resources of equipment (terminal, printers), and personnel (Admissions, Computer Center), is a realistic constraint.

Conclusion

A database system is dynamic and should be designed to grow with the needs of the organization. Eckerd College has experienced substantial growth going from a student body of 1102 in 1982, to 1351 in the fall of 1990; and an adult education program that began in 1979 has grown to a student body of 1000 in 1990. New and continued program development in the area of Special Programs such as the Management Development Institute, Leadership Development Program and Elderhostel has added to the growth cycle.

An increase in personnel to handle the demands of the growth and also the turnover in all departments on campus has created the need for continued training and re-training of end users on the part of the Computer Center personnel.

Federal reporting guidelines for colleges and universities in the areas of Financial Aid reporting

(FISAP), Accounting reporting (Inventory, IRS), Personnel reporting (EEO), and Registration statistical reporting (IPEDS), have forced changes and a demand for increased usage to the tables, programs, and data fields of the existing database system.

Both hardware and software vendors are producing frequent releases of newer versions that force organizations to stay current with technology. And, in addition, the end users at Eckerd College that have worked with the database system over the years have become experienced and sophisticated database users. This experience and sophistication has lead to a demand for specific customized database solutions.

The continued growth at Eckerd College, shows it is essential that data quantity and quality be consistent. This means that for each element of information stored in the database there needs to be an assigned responsibility for ensuring its accuracy and currency. If well-defined and prescribed policies are not institutionalized within the organization, the database can gradually become outdated, inaccurate and unreliable.

Finally, a complete systems analysis of database usage is a process that should be conducted for all the remaining modules of the database system. What has occurred in the research of one module (Admissions) may prove to be indicative across the administrative software package. The other modules have also experienced problems with initial implementation, vendor bankruptcy, limited resources, and under-utilization.

APPENDIX A

Module Review Form

(Designed for the office of Admissions at Eckerd College
by Sharon R. Setterlind, Director Computer Center.)

This form will be a step-by-step approach to systems analysis the Admissions module of the administrative software system. It will also be used to construct computer user and office procedure documentation.

Please consider each item carefully and be specific on responses to the open ended questions on how each data element and program is currently being used.

For each of the following items, please circle the Y or N response as to whether the item is being used and then based on that answer give the response in detail as to the how it is being used and why if not used.

Tables	Used	Not Used
1. AARS	Y	N

How if used/why if not used: ______________________________

____

____

____

2. ADM.REGIONS	Y	N

How if used/why if not used: ______________________________

____

____

____

APPENDIX B

Playscript

Playscript is a procedure writing technique that has a very simple format. It is used to document functions involving team work. a procedure is a function, and Playscript outlines in chronological order each step necessary to the function. Each function has a beginning (trigger) and an end (result).

The format is:

Who 1. Does what.

The actor in the left hand column (responsibility) is named by job title. The action in the right hand column begins with an *active* verb and describes the action--no more, no less.

The steps are outlined and the actor is named only when the actor changes, i.e., when the action moves from one person to another.

Playscript provides a format for procedural documentation. It is not always easy to write, but it is definitely easy to read. Once a procedure is documented in this simple format, it is easy for everyone involved to see who does what. Changes become very simple to effect.

The format makes it easy for a particular person to pick out his or her own responsibilities from the list of steps by a quick glance at the left-hand column.

APPENDIX C

Questionnaire Form

(Designed for the office of Admissions at Eckerd College by Sharon R. Setterlind, Director Computer Center.)

This form will be an open-ended questionnaire to gather information about the under-utilization of the Admissions module of the administrative software package.

Please consider each question carefully and be specific on responses to the open-ended questions on under-utilization.

1. What would you say are the strengths of the Admissions module of the administrative software application?

2. What would you say are the weaknesses of the Admissions module of the administrative software application?

3. What contributing factors would say are the reasons for the under-utilization of the Admissions module of the application software application?

4. What would you say needs to be done by the Computer Center to foster better utilization of the Admissions module of the administrative software application?

5. What would you say needs to done by the Admissions office to foster better utilization of the Admissions module of the administrative software application?

6. What would you say are the barriers to accomplishing the responses of questions 4 and 5?

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